

PROCEEDINGS

OF

The Academy of Natural Sciences

OF

PHILADELPHIA

VOLUME LXXIII

1921

PHILADELPHIA:
THE ACADEMY OF NATURAL SCIENCES

1922

6217
THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,

APRIL 24, 1922.

I hereby certify that the printed copies of the PROCEEDINGS for 1921 were mailed as follows:

Pages	1-32.....	September 12, 1921.
"	33-48.....	September 17, 1921.
"	49-64.....	October 6, 1921.
"	65-96.....	October 11, 1921.
"	97-192.....	October 14, 1921.
"	193-224.....	December 9, 1921.
"	225-240.....	December 24, 1921.
"	241-304.....	January 3, 1922.
"	305-352.....	January 4, 1922.
"	353-416.....	January 18, 1922.
"	417-436.....	January 23, 1922.
"	437-468.....	April 6, 1922.
"	469-500.....	April 11, 1922.
"	501-532.....	April 13, 1922.
"	533-552.....	April 24, 1922.

WILLIAM J. FOX, *Editor*.

PUBLICATION COMMITTEE:

HENRY SKINNER, M.D., Sc.D., WITMER STONE, A.M., Sc.D.
HENRY A. PILSBRY, Sc.D., WILLIAM J. FOX,
MILTON J. GREENMAN, M.D.

The President, JOHN CADWALADER, A.M., LL.D., *ex-officio*.

EDITOR: WILLIAM J. FOX.

CONTENTS

For Announcements, etc., see General Index.

	PAGE
ALEXANDER, CHARLES P. New or Little-known Craneflies from the Amazonian Region.....	39
BRAUN, ANNETTE F. Two Weeks' Collecting in Glacier National Park.....	1
FOWLER, HENRY W. Notes on Hemibranchiate and Lophobranchiate Fishes.....	437
GORDON, SAMUEL G. Desilicated Granitic Pegmatites.....	169
The Chromite Deposits of the State Line Serpentine.....	449
HEBARD, MORGAN. South American Blattidae from the Museum d'Histoire Naturelle, Paris, France.....	193
PENARD, E. Studies on some Flagellata.....	105
PENNELL, FRANCIS W. Scrophulariaceae of the West Gulf States.....	459
PILSBRY, HENRY A. A Revision of W. M. Gabb's Tertiary Mollusca of Santo Domingo.....	305
WANNER, H. E. Some Faunal Remains from the Trias of York County, Pennsylvania.....	25
WETMORE, ALEXANDER. A Fossil Owl from the Bridger Eocene.....	455

PROCEEDINGS
OF THE
ACADEMY OF NATURAL SCIENCES
OF
PHILADELPHIA.

1921

TWO WEEKS COLLECTING IN GLACIER NATIONAL PARK.

BY ANNETTE F. BRAUN.

During the summer of 1920, the writer had a brief, but very successful collecting trip in Glacier National Park, Montana, which disclosed an unexpectedly rich insect fauna. A total of fourteen days, in whole or part, was spent in collecting between July 14 and July 29, inclusive.

Glacier National Park lies in northwestern Montana, including within its boundaries a mass of mountain peaks, the highest of which rises to an elevation of 10,438 feet. It is traversed in a northwest-southeastwardly direction by the Continental Divide. On the west side, the waters flow into the Pacific through the Columbia River; on the east side, in the south, to the Missouri River, in the north beyond the Hudson Bay Divide, to Hudson Bay. Adjoining the park on the east lie the foothills and plains; at the lower altitudes on this side of the park, about 5000 feet, there is a blending of foothills and mountain vegetation which may in part account for the richness and diversity of the fauna in the dry mountain meadows at this altitude. It was on the east side of the park that most of my collecting was done.

Although my attention was directed principally toward securing as adequate a representation of Microlepidoptera as possible within the limited time spent in the park, specimens in other groups of

Lepidoptera were collected when the opportunity offered. The number of such species perhaps totals in the neighborhood of one hundred. In addition a few general observations on the abundance and distribution of other orders of insects in the various ecological regions and at different altitudes were made and will be referred to below.

The region is forested except at the higher altitudes and on wind-swept mountain sides, with a rather dense growth of coniferous trees. Some of the steeper rocky slopes are comparatively treeless, with a scanty herbaceous vegetation of many species, with scattered spruce and pine. In addition to these, there are two other types of comparatively treeless areas, which furnished the best collecting grounds, both as to species and numbers of individuals. One of these is the open dry rocky meadow, which supports a great variety of herbaceous plants and which yielded the greatest number of Microlepidoptera. The other is a moister meadow, with taller, more luxuriant vegetation.

The coniferous forest proved to be the poorest collecting ground in the park. This was especially true where the predominant undergrowth was the Indian basket grass; here practically nothing was secured. Where the undergrowth was of a more varied character, particularly near the margins of streams, a greater number of species was found. The Geometridae led in numbers here.

The rather open steep rocky slopes and cliffs, of which the sides of Goat Mountain above St. Mary Lake are an example, yielded some species which were not found elsewhere. Collecting here was only successful early in the morning, at sunrise just as the sun strikes the rocks, or in the late afternoon.

The moister meadow referred to above may be found in forest openings, on the moister mountain slopes, or in the more sheltered valleys, such as the valley of Canyon Creek or the upper part of Swiftcurrent Valley. The most conspicuous herbaceous plants of these meadows in July are the cow parsnip, *Heracleum lanatum*, and the false forget-me-not, *Lappula floribunda*. Shrubs abound and a dense growth of alders occurs where the water supply is plentiful enough. Such localities proved to be prolific collecting grounds. In the Microlepidoptera the most abundant and characteristic species here was *Choreutis occidentella* Dyar. *Simaethis fabriciana* var. *alpinella* Busck, several species of Incurvariidae flying in sunshine, and Pterophoridae were usually present in considerable numbers. Butterflies in limited numbers were seen also. Toward the end of

July, *Gnophaela latipennis* var. *vermiculata* became very plentiful, flying by dozens in the air above the alders. The numerous shrubs, most of which were in bloom at the time of my stay, attracted many Coleoptera, chiefly Longicorns, Clerids and Mordellids; Hymenoptera, of which the parasitic forms were especially noticeable, and many Diptera, of which by far the greatest number were Syrphidae. The Coleoptera were most plentiful during the first four or five days of my stay, and dwindled in numbers very markedly toward the end of July. These meadows lie at altitudes of 4500 feet to 5500 feet.

The dry meadow occupies drier, rocky and more exposed situations usually at altitudes around 5000 feet; good examples of such meadows where extensive collections were made are found at Glacier Park Station, the lower end of Two Medicine Lake, the north end of McDermott Lake, and on the gentle slopes near the mouth of Canyon Creek. These meadows are veritable flower gardens, exhibiting an unsurpassed richness of flora. At the end of July, the blooming period was about over at Glacier Park Station, and the meadow was becoming dry and brown, with a corresponding dwindling in species of Lepidoptera. These meadows are by far the richest of any of the localities where collections were made in point of species and numbers of individuals. Microlepidoptera were most active early in the morning, while the dew was still on the leaves, and in the evening at dusk. In most instances specimens taken in the evening were of different species from those flying in the morning. *Coleophora*, Elachistidae, some Incurvariidae, many species of Gelechiidae were the most characteristic groups present among the Tineina; Tortricids were represented by a great number of species, many very numerous in individuals, notably *Cnephasia argentana* Clerck which flew in swarms; Pyralids, among which perhaps the most common was *Pyla* sp., and many Crambids were present. Butterflies flew plentifully during the middle of the day; these were fairly numerous at all places during my stay in the park, but became especially abundant during the last five or six days of July; swarms of them congregated on every moist stream bank and on the trails. The flowering shrubs, scattered through the meadows and fringing the forests, attracted as in the moist meadows, many Coleoptera, Hymenoptera and Diptera.

The subalpine meadows occurred at the higher altitudes, 6000 feet or over, depending upon slope exposure, topographic conditions and persistence of snow. These meadows produced a disappoint-

ingly small number of species. The Gelechiid, *Gnorimoschema ochreostrigella*, was the only really common micro; some species of Tortricids were found, and Crambids were fairly numerous. Butterflies were not uncommon; and representatives of several genera of day-flying Noctuids were captured on flowers. The most striking feature of the insect fauna at the higher altitudes at this time was the presence of great numbers of Syrphus flies, representing many species. Bumble-bees were common in the meadows here, with a mimicking Syrphus fly.

The microlepidopterous fauna of the region shows a mingling of elements derived from several physiographic areas; as might be expected from its situation at the eastern edge of the Rocky Mountains, with the plains to the east, and its connection with the Pacific Coast and Sierra Nevada through the Columbia River Basin. Its position in the Northern Rocky Mountain Region relates its flora and fauna to that of the north and makes possible connections with more easterly forms. Thus we have species here hitherto reported from Texas, New Mexico and Arizona, from the more southern Rocky Mountains, from the Sierra Nevada of California, from Oregon, and species whose range includes the whole northern United States and Canada. The Lepidoptera of the Kootenai District of British Columbia (Dyar, 1904) is on the other hand, most nearly related to that of the Sierra Nevada. This region, although not far from Glacier National Park, lies entirely on the Pacific side of the Continental Divide in the Columbia River drainage basin.

All of the localities mentioned in the following pages may be found on the U. S. Geological Survey topographic map of Glacier National Park. The altitudes of the chief points at which collections were made are as follows:

Glacier Park Station, 4796 feet.

Two Medicine Lake, 5175 feet.

St. Mary, 4472 feet.

Going-to-the-Sun Chalets, on St. Mary Lake, about 4600 feet.

McDermott Lake, 4860 feet.

Swiftcurrent Pass, 7176 feet.

Granite Park, 6500 feet.

In this paper only those species belonging to the families formerly grouped together as Tineina are included. The Tortricid families of which many species were collected are omitted here. In addition to the species of Tineina recorded in this paper as occurring in Glacier National Park, many others, chiefly Gelechiidae and Cole-

ophoridae, some of them belonging to genera not reported from this country, were collected. Strangely, no member of the family Tineidae, which is usually well represented in collections from western localities, was secured.

The types and paratypes of the new species are all for the present in the writer's collection.

COSMOPTERYGIDAE.

Cyphophora tricristatella Chambers.

Occurring most commonly in dry meadows at the lower altitudes in the region (about 5000 feet); one specimen at Granite Park, July 26 (6400 feet).

Psacaphora deceptella n. sp.

Palpi dark brown outwardly, with a silvery metallic luster inwardly; antennae dark brown, apical four or five segments black preceded by six or seven white segments. Head and thorax leaden metallic, with a purplish iridescence, base of wing silvery metallic with blue and purple iridescence, followed by a large dark brown patch on costa extending a little below fold. Ground color of remainder of wing golden orange. The dark brown patch is edged outwardly and beneath by bluish silvery metallic scales, which extend outward beneath the fold to a large patch of dark brown raised scales. A similar large patch of raised scales at tornus, preceded by a streak of metallic scales which forms its inner border and then extends obliquely upward over the end of the cell to the costal cilia; on the end of the cell these metallic scales form a slightly convex patch. First discal spot round, silvery, edged with black. A white costal spot at three-fourths. Extreme margin of the wing around apex and cilia dark brown, with a faint purple luster; a row of iridescent metallic scales around apex at base of cilia from the white costal spot to the tornus. Hind wings dark brown. Legs dark brown, tips of segments whitish. Abdomen dark brown above and below. Expanse, 10 mm.

Type (♂), Glacier Park Station, July 29.

Close to *terminella* Westwood; at first glance mistakable for it. The chief points of difference are the different coloration of the antennae, the orange apex of the wings, and the details of the silvery markings.

Psacaphora sexstrigella n. sp.

Palpi silvery white, the second segment densely dusted with black in transverse rows, third segment with a few blackish specks. Face yellowish, shading to dull leaden metallic on the crown. Thorax and fore wings dark brown, mixed with leaden metallic scales, which predominate in the basal two-thirds of the wing. Basal

fifth of wing purplish; an orange spot at basal fifth below fold but not reaching dorsum; a large black scale tuft near middle of wing below fold; a similar tuft at tornus, bordered toward base with white scales; a little behind this, on costa, a large white spot; a series of six white streaks, three costal and three terminal, around apex, arranged fan-like, not reaching into the cilia. Cilia brown, paler at the base. Hind wings and cilia brownish gray. Legs black, with tips of segments and a bar across the hind tibiae white. Abdomen dark brown, tip orange. Expanse, 9 mm.

Type (♀), McDermott Lake.

The larva mines leaves of fireweed, *Chamaenerion angustifolium*, making a linear mine which enlarges into a pale greenish blotch. The imago emerged August 14.

Mompha unifasciella Chambers.

The galls common throughout the park on stems of fireweed. Imagoes emerged from August 12 to 22.

GELECHIIDAE.

In addition to the species which are referred to or described below, a limited number each of other species were collected.

Aristotelia rubidella Clemens.

Common in the dry mountain meadows at about 5000 feet.

Telphusa praefixa n. sp.

Labial palpi dark fuscous, paler inwardly; a very narrow whitish annulus is faintly indicated at the basal third of the second segment, a broad white annulus at apical third; base, an annulus before the tip and extreme tip of third segment white. Antennae fuscous, annulate with pale gray above, most distinctly toward the apex. Head pale gray, scales tipped with white. Thorax and fore wings dark fuscous, sprinkled with black scales in the middle and apical part of the wing; scales of the thorax and wing near the base minutely tipped with whitish. From basal fourth of costa an outwardly oblique pale fascia (scales pale gray, white-tipped, concolorous with the head), narrowing toward dorsum, reaches a little beyond the fold; it is bordered inwardly by a heavy line of black scales, which ends in a small patch of raised black and whitish scales just below the fold. A small patch of raised black and white scales on the fold beyond the fascia. An indistinct pale spot in the middle of costa; an irregular transverse pale fascia at three-fourths concolorous with the oblique fascia, scarcely reaches the dorsum, and sends a short broad inward projection basalwards in the middle of the wing. At the inner edge of this projection is a small patch of raised black scales. Cilia gray, speckled with white-tipped black scales. Hind wings and cilia fuscous. Legs fuscous, barred with white, tarsi white-tipped. Expanse, 13.5–14 mm.

Glacier Park Station, July 29, in a pine and aspen thicket.

Type and two paratypes in the writer's collection.

***Gnorimoschema ochreostrigella* Chambers.**

This species is very common in the open meadows at the higher altitudes. Many specimens collected at Granite Park and Swift-current Pass, 6400 to 7100 feet; July 25-26.

Some specimens show distinctly the ochreous streaking on the fore wings; in others there is scarcely a vestige of the ochreous tint, and the wing is of a dull drab color, dusted with fuscous. The expanse of wings varies in these specimens from 12 to 17 mm.

***Gnorimoschema triocellella* Chambers.**

Glacier Park Station, July 14. In some specimens the apical portion of the wing except on the extreme margins is densely dusted with nearly black scales.

***Gnorimoschema erigeronella* n. sp.**

Palpi white inwardly, densely dusted with black beneath and outwardly; base and a more or less distinct band near apex of second segment whitish; base and extreme tip of third segment whitish. Antennae whitish ochreous, banded with fuscous. Head and thorax white, specked with black, with some ochreous on the crown, and on the patagia and median line of thorax. Fore wings ochreous, marked with lines of white black-barred scales, which follow the veins and the margins of the wing, leaving the fold ochreous. The lower margin of the cell is broadly thus clothed, and the dorsal part of the wing below the fold has only a short longitudinal streak of ochreous which is sometimes entirely wanting. Around the apex the scales on the interspaces are more broadly barred with black than those along the veins. An elongate black spot or dash at the middle of the cell just below and in contact with the line of scales along the upper margin; a similar spot at the end of the cell. These are the two most distinct spots, but there is usually an aggregation of blackish scales on the fold just below the first discal spot; a similar spot on the ochreous ground color just within the costal margin near base. Hind wings silvery gray in the female, darker in the male; cilia gray with ochreous bases. Legs white, densely dusted with fuscous, hind tibiae faintly barred with white; tarsal segments tipped with white. Expanse, 11.5-14 mm.

Glacier Park Station, July 28; a specimen reared emerged August 13.

Type (♂) and two paratypes (♀); one of the females reared from an irregular mine on *Erigeron speciosus* DC., collected July 14, when most of the mines were untenanted.

This species is very close to *artemisiella* Kearf.; the two are almost identically marked, but *erigeronella* is a narrow, more slender-winged species and is considerably larger.

Gnorimoschema contraria n. sp.

Labial palpi blackish, minutely peppered with white; second segment whitish inwardly, third with a white spot within near base. Antennae dark brown with narrow paler rings. Head and thorax dark fuscous, patagia and tip of thorax reddish brown. Costal two-thirds of the fore wing reddish brown, with the costa and veins marked with lines of white broadly black-barred scales, the lines sometimes confluent in the apical half of the wing; the dorsal third of the wing from the base to the apex is clothed with white scales barred before their tips with black of varying width. The dorsal margin is distinctly lighter than the remainder of the wing. The paler dorsal portion is irregular indented with blunt tooth-like projections of the brown ground color; these teeth are partially filled up and edged with blackish scales, heightening the contrast between the two areas. Three of these patches of black scales stand out prominently; an elongate one near base, one in each of the two succeeding teeth and extending up onto the cell. Cilia fuscous, specked with whitish black-barred scales. Hind wings and cilia gray, with a faint reddish tinge. Legs densely dusted with fuscous. Expanse, 15–16 mm.

Type (♂), McDermott Lake, July 22; three paratypes (♂ and ♀), Glacier Park Station, July 14; in dry meadows.

Although allied to the other longitudinally streaked species, the paler dorsal margin gives it a very different aspect; the pattern of the dorsal half of the wing is that of *serratipalpella* Chambers. In the female, the brown ground color is less obscured by the dusted lines than in the males.

Anacamptis niveopulvella Chambers.

Common at Glacier Park Station, where the larvae feed on willow and aspen. Both this and the following species are referable to *Compsolechia* Meyrick, if this genus is maintained distinct from *Anacamptis*.

Anacamptis paltodoriella Busck.

One specimen of this beautiful species taken on the car window, exact locality not known, presumably western Montana.

The type locality is New Mexico.

Gelechia lugubrella Fab.

McDermott Lake, July 22; Glacier Park Station, July 29; in dry meadows. Previously reported in this country from Maine.

***Gelechia unifasciella* Busck.**

Two Medicine Lake, July 15-16; in dry mountain meadows. These specimens answer minutely the description of this species, the types of which came from Williams, Arizona, but the expanse is somewhat less (14-15 mm.).

***Gelechia metallica* n. sp.**

Palpi bronzy brown, brush on second segment blackish. Antennae dark brown. Head, thorax and fore wings lustrous dark bronzy brown, the wings entirely immaculate; on underside of the fore wings of the male a patch of yellowish oval slightly convex scales covers the disc. Hind wings shining pale fuscous, with slightly yellowish elongate scales on the disc. Abdomen purplish black above, underside of abdomen and legs shining dark bronzy brown. Expanse, 9.5-11.5 mm.

Glacier Park Station, July 14 and 29; Going-to-the-Sun, July 20-21; McDermott Lake, July 24; in dry mountain meadows, flying in the early morning.

Type (♂) and thirty paratypes; all males.

Very unlike any other described American species. In the hind wing, veins 3 and 4 are stalked, veins 6 and 7 closely approximated.

***Gelechia abradescens* n. sp.**

Palpi, antennae and head dark brown; outer side of second segment of palpi with a few scattered whitish scales. Thorax and fore wings shining dark brown, under a lens slightly irrorated; sometimes a few scattered whitish scales along the veins; an indistinct elongate blackish spot at about the middle of the fold, and obliquely above and beyond it in the cell a small blackish spot; a similar but larger spot at the end of the cell; at apical third a whitish spot on the costa, usually confined to the extreme costa, occasionally, especially in the female, extending about one-quarter across the wing. Cilia brownish gray, with a faint line of brown scales through the middle. Hind wings brownish gray, cilia brown at their bases. Underside of body and legs uniformly dark brown without paler markings. Expanse, 17-20 mm.

Glacier Park Station, July 14, in dry meadows.

Type (♂) and eleven paratypes (♂ and ♀).

This species seems to be allied to *pravinominella*, *ornatifimbriella* and *amorphaeella*.

The wings are very easily abraded, having then more of a dusted appearance, due to exposure of the paler bases of the scales. In such specimens the black spots are more conspicuous.

***Gelechia conspersa* n. sp.**

Palpi pale grayish brown, mixed with whitish, third segment with a minute black spot at the base outwardly. Antennae brown,

banded with whitish. Head and thorax pale grayish brown. Fore wings pale grayish brown, bases of scales whitish, dusted with scattered whitish scales, which occur singly except in the apical third of the wing, where they form ill-defined spots. A row of these extends around the apex from the apical third of costa to the tornus. The costal margin is slightly darkened before the first of these spots. A faint darker small spot on disc and a larger one at end of cell. Cilia whitish at their bases, brown at the tips with an indistinct brownish line through the middle. Hind wings pale brownish gray, cilia whitish at the base. Upper side of abdomen gray, tuft whitish. Underside of body and legs, except the hind tibiae and tarsi, dark brown, sparsely dusted with white. Hind tibiae and tarsi whitish inwardly, dusted with brown outwardly except at tips of segments. Expanse, 18-19 mm.

Type (♂), McDermott Lake, July 24; one paratype, St. Mary, July 18.

Gelechia alternatella Kearfott.

Two Medicine Lake, July 16, in dry meadows.

Gelechia versutella Zeller.

Very common on trunks of aspens, on the leaves of which the larva feeds, Glacier Park Station, July 29. The moths are practically invisible except when moving, so closely do they resemble the darker patches of bark.

OECOPHORIDAE.

Agonopteryx rosaciliella Busck.

Reared from larvae sewing together leaves of sweet cicely, *Osmorhiza* sp., near Going-to-the-Sun Chalets. Larvae collected July 21; imago, August 7.

Agonopteryx nivalis n. sp.

Palpi creamy white, slightly shaded with brownish; antennae brownish, darker toward the tips. Head, thorax and fore wings creamy white; fore wings with a faint rusty tinge beneath fold near base of dorsum and along apical third of costa. Minute brownish and blackish spots along costa, three or four larger and more diffuse on apical third; last row of scales along termen between veins, brown; a few scattered brown scales, chiefly along the veins; a very small black spot within the costa near base; a small black spot on middle of cell and obliquely above and before it, a second similar spot; a larger transverse spot at end of cell. Hind wings creamy white. Legs white, dusted with fuscous, the fore pair most densely. Expanse, 23 mm.

Type (♂), Two Medicine Lake, July 16.

Perhaps most like *pallidella* Busck, but without demarcation between basal area and remainder of wing.

***Enicostoma quinquecristata* n. sp.**

Labial palpi with the anterior edge of second segment pale reddish ochreous, a black spot near base and above middle; remaining scales of brush gray with white tips; third segment yellowish, with an annulus near base and the tip black. Antennae gray. Scales of head and thorax gray, with white tips. Fore wings ashen brown, more or less thickly bestrewn with dark gray, minutely white-tipped scales, with a tendency to longitudinal streaking in the apical third of the wing; groups of brown white-tipped scales form a series of indistinct marginal spots around the apex. Five scale tufts formed of white-tipped black scales; at one-third, a very large tuft on fold and a smaller one above in the cell; a large tuft at the lower angle of the cell and a smaller one above it; between these two pairs, on the middle of the cell, a fifth large tuft. Cilia grayish brown, with scales white-tipped. Hind wings pale gray, cilia fulvous at the base. Legs densely dusted with gray, hairs on upper side of hind tibiae pale brownish, spreading scales on underside gray with white tips. Expanse, 17–19 mm.

Type (♂), Two Medicine Lake.

The type and twelve paratypes (♂ and ♀) reared from larvae webbing leaves of *Penstemon confertus* Dougl., a common small-flowered pale yellow species, collected on the trail to Dawson Pass, Two Medicine Lake, altitude about 5500 feet. The larva lives under a web in a folded leaf, eating out patches of the leaf. The web is usually on the upper side, sometimes on the lower side of the leaf near the base. Surface of pupa clothed with fine erect hairs. Imagoes, August 6–17.

Although the food plant was common everywhere throughout the region in the dry meadow at the lower altitudes, the larva of this species was not observed elsewhere.

The generic position of the species was determined by Dr. Edward Meyrick, who states that it agrees with the type of the genus in all essential particulars, except in the palpi. In *E. quinquecristata*, the second segment of the palpi is more thickened with scales, and these are more expanded toward apex than in the type.

The genus *Enicostoma* is given in Dyar's "List" as a synonym of *Semioscopis*.

For convenience of reference, a detailed statement of the generic characters as shown by *E. quinquecristata* follows:

Head with loosely appressed scales, side tufts projecting in front; tongue developed, densely scaled except towards tip. Antennae two-thirds, with slightly spreading whorls of scales at apices of segments, alike in both sexes, basal segment without pecten. Labial palpi very long, recurved; second segment clothed with a dense

triangular brush of scales beneath and above, laterally compressed, sharp-edged in front, brush horizontally truncate at apex; third segment slender, acute, seeming to arise from center of the brush of second, visible portion about one-third the length of the second. Maxillary palpi short, appressed to tongue, third segment equaling in length the two preceding segments. Posterior tibiae clothed with long hairs above, and rough spreading long scales beneath. Fore wings with large tufts of raised scales; 1b furcate at base, 2, 3 and 4 about equidistant, 2 from near end of cell; 2 and 3 arising perpendicular to lower margin of cell, curving outward and running straight to termen; 5 nearer 4, 7 and 8 stalked, 7 to costa almost at apex, 11 from before middle. Hind wings 1, elongate-ovate, cilia 1; 3 and 4 connate, 5-7 parallel, 5 nearer 6.

Epicallima quadrimaculella Chambers.

Amongst rocks, near Going-to-the-Sun, on St. Mary Lake, July 20-21. All of the specimens were taken flying in the sunshine at sunrise, and none were seen later than 7.30 A. M.

Epicallima dimidiella Walsingham.

Two Medicine Lake, July 15; Going-to-the-Sun, July 18 and 21. Flying actively only in early morning; several taken flying in company with *E. quadrimaculella*.

Borkhausenia haydenella Chambers.

Two males and one female of this species were collected, one male at Two Medicine Lake, July 15, the other two specimens on the cliffs on Goat Mountain above Going-to-the-Sun Chalets, July 18. The female has the wing more densely dusted with white than the male, and the transverse spot at the basal third large and more clearly defined.

ETHMIIDAE.

Ethmia albistrigella Walsingham.

Two Medicine Lake, July 16; Granite Park, 6500 feet, July 25. Collected near plants of false forget-me-not, *Lappula floribunda*, which may possibly be the food plant.

GLYPHIPTERYGIDAE.

Simaethis fabriciana var. ***alpinella*** Busck.

St. Mary, July 18; Canyon Creek, 5500 feet, July 23, in openings in the forest.

Choreutis pernivalis n. sp.

Head and palpi whitish, scales of tuft fuscous towards tips. Basal half of fore wing light brown, with a broad straight pure white

fascia across the middle of the brown; fascia margined outwardly along the middle of its length with silvery scales; a basal streak of silvery scales just within the costal margin. Outer half of wing white, except a narrow band around apex and along termen, which is ochreous, dusted with white and fuscous. White patch with two longitudinal black and one or two fuscous lines of scales; the two black lines ending at the outer border of the white patch in confluent black spots, nearly overlaid with silvery scales; a wedge-shaped black spot beneath these, silvery margined, and a large quadrate black patch just above fold, with two transverse lines of silvery scales and a few silvery scales at its upper outer angle. Cilia white with a pale fuscous line through the middle. White marks more or less distinctly repeated on the underside. Hind wings more pointed than usual, brownish fuscous, underside with a whitish irregular submarginal patch; ground color shading darkest next to this patch. Underside of thorax white, abdomen fuscous. Legs whitish, tibiae and tarsi brownish. Expanse, 11.5-12 mm.

Type (♂), and one paratype (♀), Glacier Park Station, July 14.

Very close to *extrinsicella* Dyar, from which it differs by the pure white of the fore wings, the whitish irregular patch on the underside of the hind wings, and the narrower wings, particularly the narrower more pointed hind wings.

***Choreutis caliginosa* n. sp.**

Palpi fuscous and white intermixed; antennae dark brown, with white annulations. Head and thorax dark brownish gray, a few scales at the posterior margin of the head and a very narrow line along the inner edge of the patagia whitish. Fore wings dark brown; a curved whitish fascia at basal fourth, palest and broadest on the dorsum and not reaching the costa; a basal streak of iridescent scales just within the costa; outer half of the wing, except the apical part, occupied by a paler patch of whitish-tipped brown scales, marked at the inner and outer edge on the costa by a white spot, below which are a few iridescent scales; before the pale patch on the dark brown ground color in the middle of the wing is a black spot, nearly overlaid with iridescent scales. On the pale patch, above the middle, a small black spot with iridescent scales, three or four longitudinal black lines running out into the ground color in the apex; below, a large quadrate patch, sometimes divided transversely, containing two transverse patches of iridescent scales. A few iridescent scales along termen below apex. Hind wings dark brown, on underside an irregular paler submarginal band. Expanse, 10.5-11 mm.

Type (♂), paratype (♀), Two Medicine Lake, July 16; in dry meadows.

Close to *occidentella* Dyar, but smaller and darker, and with the oblique iridescent streak beyond the basal fascia in that species replaced by a black spot overlaid with iridescent scales.

Choreutis occidentella Dyar.

This is one of the commonest micros in the region at altitudes from 4500 to 5500 feet in moist meadows or forest openings. Specimens taken at Glacier Park Station, July 14; Two Medicine Lake, July 15-16; St. Mary, July 18; Canyon Creek, July 23. In some of these specimens the small black spot with iridescent scales above the large quadrate spot is absent; the ground color varies from an ochreous brown to dark grayish brown.

Choreutis balsamorrhizella Busck.

Near Going-to-the-Sun Chalets, St. Mary Lake, July 20; flying around the food plant.

PLUTELLIDAE.

Plutella vanella Walsingham.

Glacier Park Station, July 29.

Plutella maculipennis Curt.

This species was observed to be abundant in the park.

YPONOMEUTIDAE.

Argyresthia oreasella Clemens.

One specimen taken at Glacier Park Station, July 29, cannot be differentiated from eastern specimens. Oak cannot be the food plant here, at least, as there are no oaks here.

COLEOPHORIDAE.

Judging from the number collected during the short stay in the park, the region is unusually rich in species of *Coleophora*. Twelve species were collected of which ten seem to be undescribed. Of these, but two are here described, the others are either represented by too short series, or are not sufficiently striking in the absence of a knowledge of the life history, to be described except in monographic work.

Coleophora tenuis Walsingham.

One specimen, Two Medicine Lake, July 16, taken in dry meadows, answers well the description of this species, but is slightly smaller (15 mm. expanse).

Coleophora albacostella Chambers.

Very common, Glacier Park Station, July 14 and July 28, flying amongst patches of *Polygonum erectum*, upon which it probably feeds. Chambers' type came from Texas, which is included in the

range of this plant. There is one other specimen in my collection from Tolland, Colorado.

***Coleophora brunneipennis* n. sp.**

Palpi brownish ochreous, shaded with fuscous beneath and on the outer side, second segment rather long, slightly tufted, third segment a little over one-half the second. Antennae brown, banded with whitish, basal segment thickened with scales. Head, thorax and fore wings of a uniform light brown or brownish ochreous color, rarely duller with a grayish suffusion, but always entirely without markings or dusting. Cilia concolorous, toward tornus brownish fuscous. Hind wings and cilia fuscous. Legs brown. Expanse, 12-17 mm.

Type (♂), Glacier Park Station, July 14, eighteen paratypes (♂ and ♀), Glacier Park Station, July 14 and 28.

This species was much commoner on July 14 than at the later date, when only four specimens were secured. A number of the specimens were taken on flowers of *Erigeron speciosus*; some specimens were taken at the same time and place as the preceding species, amongst *Polygonum*. It is possible that one of these plants is the food plant of the larva.

***Coleophora crinita* n. sp.**

Second segment of labial palpi very long, porrected, clothed with long scales, roughened above, with a long projecting truncate tuft beneath at apex, exceeding the short third segment and sometimes concealing it, whitish, fuscous beneath and on outer side. Head and basal segment of antennae whitish ochreous, the latter slightly thickened with scales, antennal stalk white, banded above with dark brown. Fore wings pale ochreous or brownish ochreous, with the costa from base to apex white, the dorsal margin more narrowly white from base to apex of wing, a rather broad white streak from base above and parallel to the fold, a narrow parallel streak close to it just below the fold, four oblique white streaks running out into the costal cilia along the veins, two less distinct streaks running into the cilia below apex. Hind wings and cilia grayish ochreous. Legs whitish, with a fuscous line along the outer side. Expanse, 12-18 mm.

Type (♂), July 22, McDermott Lake, eighteen paratypes (♂ and ♀), Going-to-the-Sun, July 20-21, McDermott Lake, July 22 and 24; Glacier Park Station, July 29, all in dry meadows.

The long palpi, with the unusually long projecting tuft of the second segment, are the chief characters for recognition of this species. The markings of the fore wing are exactly those of *C. acutipennella* Wlsm.; in fact, the figure and description of the wing of that species would serve equally well for the present species.

Walsingham, however, mentions no unusual features of the palpi in his species.

ELACHISTIDAE.

Elachista stramineola n. sp.

Palpi whitish inwardly and above; second segment black outwardly except at extreme tip; third segment blackish outwardly except at base and extreme tip. Antennae blackish, faintly marked with narrow paler annulations. Head yellowish gray. Thorax gray, patagia whitish, sparsely speckled with fuscous. Fore wings fuscous, a little dusted with yellowish white, especially in the basal third. At base of dorsum a yellowish white patch, not extending onto the costal half of base, is specked with a few fuscous scales; a white slightly irregular fascia at one-third nearest base on costa; a triangular costal spot at two-thirds reaching halfway across the wing, and a little nearer base on dorsum a short broad whitish spot. Scales along termen yellowish toward their bases; last row of scales along termen with a whitish bar immediately preceding the black tip. Cilia gray. Hind wings and cilia pale fuscous. Legs fuscous, tips of segments and a bar across basal third of hind tibiae yellowish white. Abdomen grayish above, yellowish white beneath. Expanse, 11.5 mm.

Type (♀), Glacier Park Station, July 29, in dry meadows.

This species may be distinguished from all other species with white at the base of the wing by the dull yellowish white of the markings and the position of the basal pale patch, which is confined to the dorsal half of the wing. Venation as figured in Meyrick's "Handbook."

Elachista agilis n. sp.

Palpi dark brown, antennae dark brown. Head and thorax dark leaden metallic. Fore wings dark brown, somewhat shining, with metallic silvery or golden markings: at basal fourth on dorsum, an oblique spot reaching the fold, at middle of costa a nearly perpendicular transverse spot nearly reaching the fold, in a line with this spot a small roundish spot below the fold, a spot at tornus and farther out, a curved costal streak, sometimes nearly enclosing the apex. Hind wings and cilia brownish gray. Underside of body silvery. Legs dark brown, femora, apex and spurs of tibiae, and tips of tarsi of the hind legs silvery. Expanse, 7 mm.

Type (♂) and one paratype, Goat Mountain, above Going-to-the-Sun Chalets, about 5000 feet, July 18.

An easily recognized species, quite different from any of our described species. Venation as figured in Meyrick's "Handbook."

Elachista aurocristata n. sp.

Palpi white, antennae white, shading outwardly to fuscous in the male. Head, thorax and fore wings white, with a scarcely perceptible

tible yellowish tinge in the female. Fore wings usually entirely immaculate, sometimes with a few scattered brownish ochreous scales; one or two such scales near end of fold, at end of cell and in the apex and along termen. A faint narrow blackish line sometimes present in the cilia at apex and along termen. Hind wings white or pale gray. Legs white, shaded with fuscous. Abdomen white, in the male shaded with golden yellow beneath, and with a golden yellow anal tuft. Expanse, 12 mm.

Glacier Park Station, July 14 and 29; in dry meadows.

Type (♂) and three paratypes (one ♂ and two ♀'s).

Only in one of the males are the scattered ochreous scales present on the fore wings; the wings in the other three specimens are entirely immaculate.

Allied to *E. orestella* Busck, with which it agrees in venation; but easily distinguished by the golden anal tuft of the male.

***Tinagma gigantea* n. sp.**

Labial palpi yellowish white above, scales of tuft grayish. Antennae grayish, tinged with ochreous beneath. Head and thorax dusted about equally with whitish and pale gray. Scales of the ground color of the fore wings are pale gray at their bases, shading into white of varying width, followed by a black tip. A broad blackish transverse fascia just before middle of wing, ill-defined on its inner edge, narrowly margined with white on its outer edge, and outwardly obtusely angulated on the cell; a similar dark shade, its margins not defined, crosses at two-thirds, fading out into the general ground color toward apex. Marginal row of scales nearly black, cilia dark gray. Hind wings dark gray. Legs blackish, slightly dusted with gray; tips of tarsi pale gray. Expanse, 14-15 mm.

McDermott Lake, July 22-24; Going-to-the-Sun, July 20; Glacier Park Station, July 28-29; in dry meadows.

Type (♂), July 24; twenty-one paratypes.

This species flies at dusk. The moth has the peculiar habit of slowly raising and lowering the wing.

The markings are similar to those of *T. obscurolfasciella* Chambers, but *T. gigantea* is much larger and lacks the brownish tint of that species.

***Tinagma pulverilinea* n. sp.**

Labial palpi white, with black specks outwardly. Antennae pale gray. Head and thorax white, dusted with black. Scales of the general ground color of the fore wing with base gray, followed by a usually broad white bar, black-tipped. A broad dark transverse fascia just before middle of wing, convex outwardly and bordered outwardly by a row of scales which are almost entirely white. A

similar dark fascia at two-thirds, convex inwardly and bordered inwardly by a broken line of white scales. In some specimens, the effect of these two white margins with the whitish dusted scales between them is that of a bi-concave dusted white-margined fascia. The second dark fascia sometimes passes imperceptibly into the white dusted apex, sometimes is more or less limited outwardly by an incomplete line of white scales. Marginal line of scales fuscous, cilia gray. Hind wings gray. Legs white, dusted with black, hind pair most densely. Thorax beneath nearly pure white, abdomen dusted with black. Expanse, 9-11 mm.

On cliffs on the side of Goat Mountain, above Going-to-the-Sun Chalets, July 18, flying in the sun.

Type (♂) and four paratypes (♂ and ♀).

In general appearance quite different from the other two American species of the genus, but with the same type of markings.

GRACILARIIDAE.

Lithocolletis oregonsis Walsingham.

Mines collected near Baring Creek, July 20, on *Symphoricarpos* sp. The mine is a small tent mine on the underside of the leaf, with epidermis much wrinkled and a patch of leaf tissue in the middle of the mine not consumed. Imago, July 28. The species was described from Oregon.

Acrocercops astericola F. and B.

McDermott Lake, July 24. I also have specimens of this species from southern Oregon.

Gracilaria acerifoliella Chambers.

I refer with little doubt to this species, specimens reared on a bush maple (*Acer* sp.), near Going-to-the-Sun Chalets.

In these specimens, there is none of the brown dusting described by Chambers for this species, but the wings are pale brownish or reddish ochreous, with purple reflections and a pale costal triangle produced along the costa. Inasmuch as similar undusted forms occur in other species (for example, *G. ostryaella* Chambers), the identification is probably correct. The larval habits agree closely with those described for *G. acerifoliella*; a large leaf is often entirely folded up by the time the larva finishes eating.

Larvae collected July 18, imagoes August 6-14.

Gracilaria alnivorella Chambers.

The larvae were very common at the lower altitudes on alder.

SCYTHRIDAE.

Scythris magnatella Busck.

Larvae in webs on fireweed (*Chamaenerion angustifolium*), imagoes August 5.

Scythris impositella Zeller.

Glacier Park Station, July 29. Mines, presumably of this species, were observed on *Aster* and on *Arnica* sp.

Scythris eboracensis Zeller.

Two Medicine Lake, July 16; Going-to-the-Sun, July 20-21. Some of these specimens are unusually pale and grayish.

LYONETIIDAE.

With the exception of *Tischeria heliopsisella* Chambers, which was a common miner on sunflower near Baring Creek, only one other member of this family was observed, a *Bucculatrix* feeding on *Arnica* sp.

INCURVARIIDAE.

Lampronia quieta n. sp.

Palpi brownish yellow, outer side of labial palpi dark brown; antennae dark brown; face and head brownish yellow. Thorax brown, patagia and a small spot on the middle of the base of the fore wing buff. Fore wing brown, scarcely shining, marked with pale buff spots; a large oblique quadrate spot at basal fourth on dorsum, reaching a little more than halfway across the wing; a large costal spot at two-thirds, concave on its inner side, convex on its outer side, and produced a little along the costa towards apex; a dorsal spot just before tornus, with its inner edge perpendicular to the margin, its outer edge oblique; a narrow elongate spot along termen below apex; costal cilia brown, buff-tipped towards apex, cilia buff at apex and on termen to the lower end of the buff spot, thence dark brown to the tornus. Hind wings and cilia gray. Legs buff, the two anterior pair with fuscous shading. Expanse, 18 mm.

Type (♀), Canyon Creek, 5500 feet, July 23; resting on a rock near the water.

Nearest to *tailorella* Kearf., but without the purple and coppery luster of that species.

Lampronia obscuromaculata n. sp.

Palpi gray, second segment of labial palpi white above; antennae gray, white scaled toward base, cilia of the male 1; head with gray and whitish hairs intermixed. Fore wings shining very pale gray, with a few scattered fuscous scales, base of costa fuscous; marked

with scarcely defined white spots and fasciae placed as follows: a spot in the fold near base; a quadrate spot on basal third of dorsum reaching just beyond fold; just beyond middle a transverse fascia; at apical fourth of costa a spot reaching about halfway across the wing. Hind wings and cilia gray, darker than the fore wings, with purplish iridescence, thinly scaled. Legs gray. Expanse, 15 mm.

Type (♂), Two Medicine Lake, July 16; in dry meadows.

In this specimen, veins 7 and 8 of the fore wing are coincident as in *Greya*, but the other characters and the general habitus of the insect are those of *Lampronia*. As shown by the following species, such individual variations occur.

***Lampronia variata* n. sp.**

Palpi brownish gray, labial palpi with whitish scales above; antennae black; head brownish, some whitish hairs on the face. Thorax and fore wings shining bronzy brown; at basal third of dorsum a pale yellowish spot reaching the fold; just before tornus a pale yellowish spot reaching two-thirds across the wing. Tips of cilia whitish. Hind wings dark brown with a faint purple luster. Legs dark brown. Expanse, 11 mm.

Type (♂), Two Medicine Lake, July 16; paratypes (♂ and ♀), Two Medicine Lake, July 15, in forest openings.

In some of these specimens 7 and 8 of the fore wings are coincident.

***Lampronia politella* Walsingham.**

Three males, Two Medicine Lake, July 15, Going-to-the-Sun, July 21, collected in early morning in the dry meadows. The expanse, 18–20 mm., is somewhat more than that given by Walsingham; but in other respects, these specimens agree closely with the description, showing very markedly the aeneous tinge of the fore wings.

***Lampronia piperella* Busck.**

Two Medicine Lake, July 15, in dry meadows; one female specimen which has all the veins of the fore wing present and palpal characters as in the other species of the genus, and not as described for the very similar *Greya punctiferella* Walsingham.

CHALCEOPLA nom. nov.

This generic name is proposed to replace *Cyanauges* Braun (Ohio Jour. Sci., XX, 24, 1919), preoccupied by *Cyanauges* Gorham in the Coleoptera.

***Chalceopla itoniella* Busck.**

Two Medicine Lake, July 16; Canyon Creek, July 23; Swift-current Valley, July 27; flying in sunshine.

In *Chalceopla itoniella* veins 7 and 8 of the fore wing are separate, as is also the case in the two following species. The genus *Chalceopla* is most easily recognized by the spreading bristles below and at apex of second segment of the labial palpi, the minute or small maxillary palpi and the two kinds of scales, the greenish or bluish broad scales and the elongate metallic scales.

***Chalceopla cockerelli* Busck.**

Two Medicine Lake, July 16.

***Chalceopla ovata* n. sp.**

Second segment of labial palpi white, with black bristles, terminal segment black; hairs of head whitish; antennae black. Thorax and fore wings shining bronzy brown, with pale yellowish markings; a small elongate spot in fold near base; a spot on middle of dorsum reaching fold; an oblique curved patch at three-fifths of costa is narrow on the costa, but expands into an oval in the middle of the wing. Hind wings dark brown with a purple tinge, and with dull golden metallic scales on the margin projecting into the cilia. Legs dark brown with a bronzy luster. Expanse, 7.5 mm.

Type (♀), July 18, on the cliffs on Goat Mountain above Going-to-the-Sun Chalets.

There is no differentiation in shape between the metallic overscales and the ordinary scales in this species in the fore wing; on the hind wing, metallic scales are only found at the extreme margin.

***Greya subalba* n. sp.**

Labial palpi whitish, third segment black beneath; maxillary palpi short, folded portion reduced to a short segment, which is usually not bent over in the dead insect; antennae gray; head white. Fore wings varying in color from shining white to pale buff, with base of costa fuscous. Hind wings gray, with whitish cilia. Legs white, fuscous shading on the two anterior pair. Expanse, ♂, 14–16.5 mm.; ♀, 11–14 mm.

Type (♂), Two Medicine Lake, July 16; twenty-two paratypes (♂ and ♀), Glacier Park Station, July 14; Two Medicine Lake, July 15–16, McDermott Lake, July 23, all in dry meadows.

The whitish immaculate fore wings distinguish this species from the others of the genus. The terminal segment of the maxillary palpi is only about half the length of the corresponding part in *Greya solenobiella* Wlsm.

MICROPTERYGIDAE.

ACANTHOPTEROCTETES new genus.

Labial palpi very short, directed outwardly. Maxillary palpi long, filiform, folded. Tongue short. Head densely rough-haired. Antennae four-fifths, slender, filiform, smoothly scaled, basal segment slightly swollen. Middle tibiae with one apical spur, posterior tibiae smooth, middle and apical spurs long.

Fore wing: elongate lanceolate, fibula large, second and third anal veins separate and distinct to the margin, *Cu* and 1st *A* coalesced at base, posterior arcus distinct, *Cu*₁ and *Cu*₂ distant, base of media distinct, not forked within the cell, forming an almost straight line with *M*₃₊₄, transverse vein perpendicular between *Cu*₁ and *M*₃₊₄, and nearly meeting the very oblique transverse vein between *M*₃₊₄ and *R*₄₊₅, which becomes obsolescent near *M*₃₊₄, *M*₂ arising near the middle of the oblique transverse vein, *M*₁ from middle of stalk of *R*₄ and *R*₅, *R*₄ and *R*₅ long stalked, *R*₅ to apex, *R*₂₊₃ coincident, from near end of cell, *R*₁ from before middle, with an accessory vein, *Sc* not forked, humeral vein present.



Hind wing: elongate lanceolate, a little narrower than the fore wing, without frenulum, but with series of costal spines, venation similar to that of the fore wing, with the exception of the anastomosis of the first and second anal

veins near the base, the absence of the transverse vein between *Cu*₁ and *M*₃₊₄, absence of accessory vein from *R*₁.

Genotype, *Acanthopteroctetes tripunctata* n. sp.

The forking of the base of media nearer to the margin than in other Micropterygid genera has resulted in a nearly straight discal vein, and a consequent configuration of the discal cell similar to that in other Lepidoptera. The presence of three separate anal veins in the fore wing is an unusual feature. The presence or absence of a cross-vein between the first and second anal veins of the fore wing could not be observed without injury to the unique type.

This genus belongs in the subfamily Eriocraniae, but is not closely related to any described genus. It is nearest to *Eriocrania*.

In addition to the species described below, I have a single specimen, in rather poor condition, of another species of this genus from the southern Sierras.

***Acanthopteroctetes tripunctata* n. sp.**

Palpi brown with a slight golden tinge, hairs of the head reddish brown; antennae blackish brown, basal segment paler. Fore wings brown, with a faint golden and purplish luster, bases of scales a little paler; a slightly irregular yellowish spot on the disc at one-third, at three-fifths, a yellowish costal and an opposite dorsal spot nearly meeting. Scales at apex a little paler. Hind wings brown, a little darker than the fore wings. Legs dark brown. Abdomen dark brown, median line beneath paler. Expanse, 11 mm.

Type (♂), Canyon Creek, 5500 feet, July 23; flying in sunshine in a forest opening.

The general appearance of this moth suggests a Tineid rather than a Micropterygid.

**SOME FAUNAL REMAINS FROM THE TRIAS OF YORK COUNTY,
PENNSYLVANIA.**

BY H. E. WANNER.

Plants from the Trias of York County have been reported and described under thirty-three species, twelve of which are new.¹ In the same region, so productive of fossil flora, faunal remains have been less in evidence. Only three species, all based on fragmentary saurian remains, have been described, two by Cope and one by Sinclair.²

In the hope that a contribution to the knowledge of the faunal life of this locality would be an acceptable addition to the palaeontology of the Newark System, this paper is presented.³

I am indebted to my father for inspiration and for whatever love of the science of geology I possess. He materially assisted in the field work and in the collection of specimens. I am also under obligations to Dr. H. A. Pilsbry for counsel and assistance and for the extension of every courtesy in granting me access to the data in The Academy of Natural Sciences of Philadelphia; to him also belongs the credit for the description and identification of the Mollusca. Dr. John M. Clarke, of the New York State Museum, kindly gave me the benefit of his wide knowledge in the consideration of *Spirorbis*.

DESCRIPTIVE GEOLOGY.

The Trias of York County rests, non-conformably, on the Lower Cambrian.⁴ This is shown in the railroad cut just north of Emigsville. The triassic rocks, dipping N. W. at an angle of 16 degrees, rest on the Lower Cambrian shale and limestone. The latter dip

¹ Ehrenfeld, F. A study of the igneous rocks at York Haven and Stony Brook, Pa. Univ. of Penna., 1898. Wanner, A. Triassic flora of York County, Pa. U. S. Geol. Survey, Ann. Rept., pp. 233-255, 1898-99.

² Cope, E. D. Description of vertebrata from the Triassic formations of the United States. Amer. Phil. Soc. Proc., vol. XVII, p. 232, 1878. Sinclair, W. J. A large Parasuchian from the Triassic of Pennsylvania. Amer. Jour. Sci., vol. XLV, pp. 457-462, June, 1918.

³ Most of the field work and the collection of material were done in the summer of 1920.

⁴ Walcott, C. D. The Cambrian rocks of Pennsylvania. U. S. Geol. Survey, Bull. 134, 1892.

to the S. W.⁵ The basal layer here is a limestone conglomerate. Sandstones, shale and conglomerates occur in the succeeding layers and farther north a large intrusion of diabase. This forms the elevation known as the Conewago hills. All of the rocks examined dip N. W. at an angle varying from 15 to 24 degrees. No evidences of faulting or folding were observed.



Fig. 1.—Localities of triassic exposures mentioned herein.

The localities described in this paper are about three miles north of Emigsville (fig. 1). Taking the average dip as 20 degrees and calculating from the dip and horizontal distances, the productive layers are, approximately, 6600 feet above the basal conglomerate.⁷ Correlation and definite location of these layers is difficult without a section across the Trias.

Two columnar sections are given (figs. 2 and 3) showing the relative positions of the productive strata. These sections are of interest because they show the rapid alternation of the sediments. The physical and lithological character of the shale varies considerably even in the same layer. In one place it may be hard and compact

⁵ Frazer, P. Penna. Geol. Survey, Report C 3, Sec. 2, 1876.

⁶ Russell, I. C. The Newark System. U. S. Geol. Survey, Bull. 85, p. 34, 1892.

⁷ Ehrenfeld, F. A study of the igneous rocks at York Haven and Stony Brook, Pa. Univ. of Penna., 1898. Wanner, A. Triassic flora of York County, Pa. U. S. Geol. Survey, Ann. Rept., pp. 233-255, 1898-99.

Columnar Section	Thickness in Feet	Character and Distribution
	30+	Heavily bedded micaceous red sandstone
	20	Friable red shale
	5.5	Green shale
	1	Red sandstone
	5	Green shale
	3	Black shale
	12	Micaceous green sandstone
	30+	Green shale with mica

Columnar Section	Thickness in Feet	Character and Distribution
	16+	Thinly bedded sandstone with mica and feldspar, with Tracks
	2	Red shale
	19	Red sandstone with conglomerate interbedded Tooth in the conglomerate
	46	Thinly bedded friable red shale and sandstone with mica and feldspar.
	16+	Heavily bedded red sandstone with mica

Figs. 2 and 3.—Sections showing relative positions of fossiliferous strata.

and in another friable and soft. The color may be red or green. Its content of silica, clay, feldspar and mica varies.

HISTORICAL GEOLOGY.

In general, geologists now regard the theory of continental origin of the beds of the Newark System as definitely proven.^{8 9 10}

From the floral remains the triassic rocks of York County are placed by Fontaine in the Upper Trias and correlated with the Rhetic of Bavaria.¹¹ Lull, from the faunal remains of the Connecticut valley, states that "the Newark System may bridge the time between the Triassic and Jurassic."¹²

The presence of at least five different fresh-water mollusca in the York County Trias is indicative of fresh rather than saline-water conditions. The carbonaceous black shale containing the fish scales and fossil plants proves the presence of luxuriant vegetation in swamps, or lakes. This conclusion is still further verified by the occurrence of thin coal lenses and numerous casts of limbs.¹³

CRUSTACEANS.

The shells of two species of small crustaceans are found closely associated in the black shales. These were identified as *Candona rogersi* (Lea) and *Estheria ovata* (Jones).¹⁴ The former are found more abundantly and often cover the surface of the matrix in densely crowded masses. Localities: Carbonaceous shale, Little Cone-wago (loc. 3); Black shale, York Haven (loc. 4).

FISHES.

The great variety of fish scales (Plate I, figs. 1-17) warrants their presentation. Some of the specimens are sufficiently different from known forms to indicate the presence of new species. The scales

⁸ Russell, I. C. The Newark System. U. S. Geol. Survey, Bull. 85, Chapter V, 1892.

⁹ Davis, W. M. The Triassic formation of Connecticut. U. S. Geol. Survey, 18th Ann. Rept., pp. 32-34, 1898.

¹⁰ Barrell, J. Relations between climatic and terrestrial deposits. Jour. Geol., vol. XVI, pp. 182, 259, 1908.

¹¹ Ward, L. F. Status of the Mesozoic floras of the United States. U. S. Geol. Survey, 20th Ann. Rept., p. 255, 1898-99.

¹² Lull, R. S. Triassic life of the Connecticut Valley. Geol. and Nat. Hist. Survey of Conn., Bull. 24, p. 20, 1915.

¹³ Wherry, E. Silicified wood from the Trias of Pennsylvania. Acad. Nat. Sci. Proc., Phila., 1912.

¹⁴ Jones, T. R. A monograph of fossil Estheriae. Palaeontographical Soc., pp. 84, 124, London, 1862.

occur in a matrix containing macerated and obscured remains of vegetation, an occasional fish spine, and minute fragments of bones. A striking characteristic of nearly all the scales found is their highly enamelled coating. By reason of the fragmentary nature of the material, no attempt has been made at identification. However, because of the enamelled surfaces of the scales, there is probably sufficient justification for provisionally classifying the fishes as ganoids.¹⁵

Locality: Carbonaceous shale, Little Conewago (loc. 3).

REPTILIAN REMAINS.

Coprolites (Plate I, figs. 18, 19) are found associated with the fish remains. These are usually of an elongated, oval form, varying in shape, and from 2 to 60 mm. in length. A cross section made through one of these reveals fish scales and microscopic fragments of bones.

Localities: Shale, York Haven (loc. 4); Carbonaceous Shale, Little Conewago (loc. 3).

A few bones and teeth have been found in the Trias of York County. Some of these have been referred to species by Cope and Sinclair.¹⁶ No attempt was made by either of these authorities to locate the horizon. The conglomerate layer shown in the section made along the Big Conewago creek yielded a fragment of a tooth with serrated edges. An extensive search failed to uncover additional fossil remains, but further search may be productive.

Locality: Conglomerate, Big Conewago (loc. 2).

TRACKS.

Reptilian footprints have been reported from the Trias of York County.¹⁷ Two new localities have produced small tracks on thinly bedded micaceous sandstone. These differ from any previously described from this region. They can be referred to three types.

One consists of two parallel rows of crescent-shaped impressions with the longer diameter at right angles to the trend of the trail. Spread of track 10 mm. and average distance between successive footprints, 4 mm. (fig. 4, no. 1).

¹⁵ Newberry, J. S. Fossil fishes and fossil plants of the Triassic rocks of New Jersey and the Connecticut Valley. U. S. Geol. Survey, Mon. XIV, 1888.

¹⁶ Cope, E. D. Description of vertebrata from the Triassic formations of the United States. Amer. Phil. Soc. Proc., vol. XVII, p. 232, 1878. Sinclair, W. J. A large Parasuchian from the Triassic of Pennsylvania. Amer. Jour. Sci., vol. XLV, pp. 457-462, June, 1918.

The second type consists of indistinct, circular tracks. The distance between successive imprints is 15 mm. Running parallel on the same slab, 90 mm. distant, is a similar series; the two are probably associated. Their rounded outlines indicate that these trails were made under water by a creature either wading or swimming (fig. 4, no. 2).

The third type consists of three related impressions, similarly placed. The distance between impressions is 30 mm. The lack of distinctness prevents a more detailed description. From their appearance they were evidently produced under water (fig. 4, no. 3).

Locality: Sandstones, Big Conewago (loc. 1 & 2).

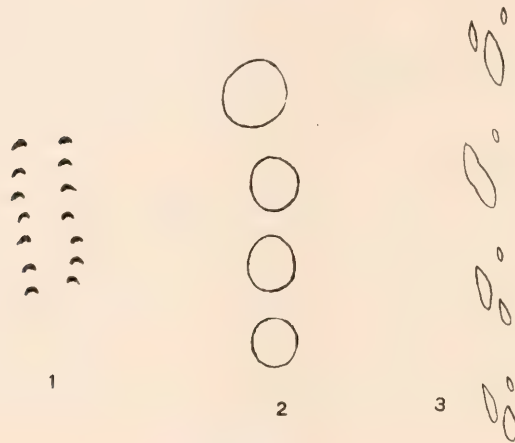


Fig. 4.—Tracks.

MOLLUSKS.

Shells and casts of different Mollusca were found. Some of them evidently represent new species. Since the literature on the Triassic fresh-water Mollusca is meager, it was considered desirable that these specimens should be identified and described by an authority. In consonance with this decision, they were referred to Dr. H. A. Pilsbry, whose report follows.

The Mollusca so far found belong to the fresh-water families Unionidæ and Mutelidæ. Species of the former family have been described from the Trias of the Dockum beds of the Staked Plains

¹⁷ Wanner, A. The discovery of fossil tracks in the Trias of York County, Pa. Second Geol. Survey of Penna., Ann. Rept., pp. 31-35, 1887.

of Texas by C. T. Simpson,¹⁸ and from the Connecticut Valley by Emerson and Troxell.¹⁹ All of these authors referred their species to the northern genus *Unio*; but Simpson subsequently²⁰ decided that at least part of the Texan species were related to South American genera, though he did not expressly alter the generic references. A list of American Triassic species follows:

Species from the Dockum beds, Staked Plains of Texas: *Unio subplanatus*, *Unio dumblei*, *Unio graciliratus*, *Unio dockumensis*, all of Simpson.

Species from Trias of the Connecticut Valley: *Unio emersoni* Troxell, *Unio wilbrahamensis* Emerson.

The third and fourth species, at least, might better be referred to the genus *Diplodon*, having radial beak sculpture. Probably the others will also prove to have similar sculpture when material sufficiently well preserved comes to hand.

In three of the York species the radial sculpture of the beaks shows relationship with South American genera, being like that of *Diplodon* and *Hyria*, and totally unlike that of *Unio* and allied genera of the Northern Hemisphere. These species are herein referred to the genus *Diplodon*. In two other York species the beaks themselves are not preserved well enough to make out their sculpture; but as there is corrugation of the posterior slope, it is likely that the beaks are radially folded and that these also are referable to *Diplodon*.

The genus *Mycetopoda*, here recognized as a Mesozoic fossil for the first time, is a South American genus belonging to the Mutelidae, a family of the southern continents.

The records for Triassic Unionidæ are as yet few; but the wide separation of the localities, the presence of several species and their considerable diversity in shape and sculpture in each area, may permit the inference that Triassic North America possessed a large and varied Naiad fauna of South American type, Hyriinæ and Mutelidæ. The next fauna of these mussels of which we have any definite knowledge is that of the Jurassic in Colorado and Wyoming. Here the South American types have entirely disappeared, and in their place are distinctively Holarctic Unioninæ, in which

¹⁸ Description of four new Triassic Unios from the Staked Plains of Texas. Proc. U. S. Nat. Mus., 1895, pp. 381-385.

¹⁹ American Journal of Science (4), vol. 38, 1914, p. 460.

²⁰ Synopsis of the Naiades or Fresh-water Pearly Mussels, 1900.

the beak sculpture when known is of the concentric type.²¹ These were probably immigrants from Asia. Similar forms occur more abundantly in the Laramie.

Williston, from a study of the reptiles, holds that America was isolated from the Old World throughout the Permian and well into the Triassic, a broad connection being established in the Upper Trias.²² It appears likely that the subfamilies of Unionidæ were differentiated in this long interval from the Pennsylvanian to the Trias, the Unioninæ in Eurasia, while America had Hyriine mussels, which disappeared with the advent of Old World forms in Upper Trias or Jurassic. The migration of Unionidæ would doubtless lag far behind that of reptiles after the connection was established.

Diplodon pennsylvanicus n. sp. Pl. II, figs. 1 (type), 2, 3; pl. III, fig. 4.

The type consists of the two valves of one individual, spread open. On the same piece of hard gray shale there is another imperfect valve of the same species.

The shell is oblong, not unlike a young *Unio complanatus* (Sol.) in shape, being rather compressed. The beaks are at about the anterior third. The posterior ridge is rounded, a radial depression above it on the posterior slope. Sculpture of numerous folds radiating from the beaks and reaching to about the middle of the valve except posteriorly, where they are longer. Below the radial folds there are some low, concentric wrinkles.

Length 21 mm.; alt. 10.5 mm.; diam. about 6 mm.

Locality: Shale, Little Conewago Creek (loc. 5).

The specimen selected as type is not full grown, but the valves are free from distortion, and the sculpture is finely preserved. Adult shells, such as that shown in Plate III, figure 4, reach a length of 32 mm., alt. about 18 mm., diam. about 10 mm. The radial sculpture covers a relatively smaller part of the valves, though actually about the same area as in the type.

Another specimen, obliquely compressed, is shown in dorsal aspect in Plate II, fig. 2. Alt. about 20 mm.

²¹ In some of the Laramie and later Uniones there are oblique folds, superficially like those of *Diplodon*, as in *Unio (Loxopleurus) belliplicatus* Meek; but on the beaks the sculpture is concentric. Certain Uniones described by Whitfield, Bull. Amer. Mus. N. H., XIX and XXIII, from the Montana Laramie, have sculpture recalling *Diplodon*, but more like the Asiatic *Parreysia*. They form, I think, a special group, near *Parreysia* or a subgenus thereof, which may be called *Proparreysia*, the type being *Unio percorrugata* Whitfield.

²² This connection is usually mapped as across the North Atlantic (see Arldt, Handbuch der Palaeogeographie, I, 1919); but it may have been in the north-west.

The interior of a left valve (Plate II, fig. 3) shows a moderately deep beak cavity. The muscle scars are indistinct, but so far as visible seem as in *Unio*. The pseudocardinal teeth are moderately strong, double, nearly smooth. The single blade-like lateral tooth is well developed but short, and rather widely separated from the pseudocardinals. This shell was 32 or 33 mm. long.

This is the most abundant species; remains of some 14 individuals have been found.

This species appears to be related to *Unio dockumensis* Simpson, from the Trias of Garza County, Texas, having similar though more extensive radial corrugation. That shell is about double the size of *pennsylvanicus*.

***Diplodon borealis* n. sp.** Figs. 5, a, b, c.

Three specimens represent a species resembling *D. pennsylvanicus*, but plumper, smaller (if these are of full growth), with the beaks nearer the middle, at about the anterior two-fifths of the length.

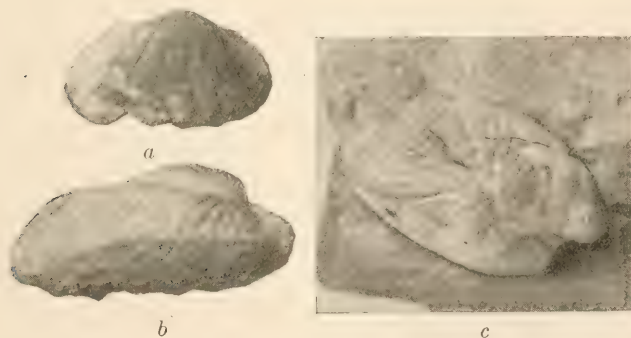


Fig. 5.—*Diplodon borealis* n. sp.

The sculpture consists of rather widely spaced radial furrows, much narrower than their intervals, which are flattened and show irregular, weakly festooned concentric wrinkles in places. At the anterior and posterior ends the radii are finer, and have the form of corrugations. The best preserved specimen measures:

Length 14.5 mm., alt. 8.5 mm., diam. 7.3 mm. (fig. 5a).

Another distorted shell is 20 mm. long (fig. 5b). This is also about the length of the third specimen, in which one valve is partially imbedded in hard shale, and the other somewhat compressed towards the base (fig. 5c).

Locality: Gray shale, Little Conewago Creek (loc. 5).

Diplodon wanneri n. sp. Plate III, fig. 5.

The shell is oblong, compressed, with small beaks, but little projecting, at about the anterior fourth of the length. The dorsal outline is moderately arched; anterior end evenly rounded, posterior end somewhat oblique, rounded; basal margin straightened. The posterior ridge is prominent but rounded. Surface is smooth, except for unequal wrinkles of growth. There is a gray-white calcareous layer about the thickness of writing paper, covering the shell like a periostracum (broken away in places). The interior is unknown.

Length 37 mm.; alt. 22 mm.; diam. 11.7 mm.

No traces of beak sculpture are discernible in the type specimen, which, as mentioned above, is covered with a thin layer of calcite. A much flattened specimen shows the beak sculpture (fig. 6). There are fine corrugations diverging from the posterior ridge, gradually weakening, and finally disappearing about 17 mm. from the beak. In the median part of the valve the fine corrugations radiating



Fig. 6.—Beak sculpture of *Diplodon wanneri*, paratype. Diagrammatic.

from the beaks are gently curved towards the middle, though only a few of them meet (*Hyria* fashion). The branching of the corrugations produces some faint appearance of zigzag pattern in the middle. In this region the sculpture reaches only about three or four mm. from the beaks. Total length of this shell is about 33 mm.

Locality: Shale, Little Conewago Creek (loc. 5).

Diplodon carolus-simpsoni n. sp. Plate II, figs. 4, 5, 6.

The type is a left valve, imperfect in the anterior-basal region, with part of the right valve almost wholly imbedded in the hard, dark gray shale.

The shell is oblong, plump, rather thick (1.6 mm. at about the posterior third). The beaks are full and prominent, near the anterior end, which is rounded. Posterior end is oblique, being produced at the post-basal extremity. The posterior ridge is prominent and rounded. Sculpture of rather strongly marked lines and wrinkles

of growth, and on the posterior ridge, radiating, fine folds; dorsad of the ridge, on the posterior slope, the folds form a dorsally curved corrugation. The ligament is strong and prominent.

Length 34 mm.; alt. 22 mm.; diam. 19 mm.

Another specimen (Plate II, fig. 6) from the same locality, but from a different bed, is in the conglomerate of a deep brownish drab color. As usual in this rock, the surface is not well preserved, but the outlines are perfect. The corrugation of the posterior slope, distinct in the type, is not legible. It measures:

Length 45.5 mm.; alt. 25 mm.; semi-diam. 9.5 mm.

In outline, this species resembles *Unio graciliratus* Simpson of the Dockum beds, Dickens County, Texas; but in that shell the lirations of the posterior slope appear to run parallel to the posterior ridge, not diverging upwards towards the ligament, as in the Pennsylvanian species; also they continue to the posterior end, while in our species the corrugated area is much less extended.

It is named in honor of Mr. Charles T. Simpson, whose work initiated the modern classification of Unionidæ.

Locality: Shale, Little Conewago Creek (loc. 5).

Diplodon yorkensis n. sp. Plate III, figs. 2, 2a.

The type is a nearly perfect specimen showing nothing suggesting distortion of the original form.

The shell is long, narrow and plump, the diameter and altitude about equal. The moderately full beaks are about 28 per cent. of the length from the anterior end, which is rounded. The posterior end slopes obliquely, the posterior-basal angle being produced. The posterior ridge is prominent, rounded, the basal margin straight, the middle of the valves flat. The surface shows rather strong, unequal wrinkles of growth where best preserved. On the dorsal slope there appears to be some trace of fine, curved, radial corrugation posterior of the beaks.

Length 32 mm.; alt. 11.5 mm.; diam. 11.7 mm.

This species is quite distinct by its long, plump shape. Since the above account was written a second specimen has been found. In this the valves are spread partly open. Each shows a depression running from the beaks obliquely downward and backward to the basal margin. There are radial riblets on the beaks, though mostly obliterated, and a fine corrugation on the dorsal slope behind the beaks, the corrugations radiating from the posterior ridge and curving towards the dorsal margin, thus confirming the indistinct traces of such sculpture shown by the type specimen. This shell is larger than the type, 40 mm. long, and similar in other proportions.

Locality: Shale, Little Conewago Creek (loc. 5).

Mycetopoda diluculi n. sp. Plate III, fig. 1.

The single example is imbedded in reddish shale, showing part of one side and a section, from presumably near the anterior end, which is broken away.

The shell is quite compressed, apparently rather thin, of long, narrow, straight form. The surface shows distinct wrinkles of growth, which by their outlines indicate a rather strongly tapering posterior end.

The length of the part preserved is 99 mm. Alt. at broken end 30 mm.; further back, where the ventral margin is visible, the alt. is about 25 mm. Diam. at broken end 9.5 mm.

Mycetopoda is a recent genus of South America, with a few species as far north as Nicaragua and Guatemala. While the generic reference of the fossil is not positive, the interior being unknown, its characters, so far as they are legible, agree well with *Mycetopoda*, and appear to indicate this genus or one closely similar.

Locality: Shale, Little Conewago Creek (loc. 5).

POLYCHAETA.

Spirorbis inexpectatus n. sp. Plate III, fig. 3.

In the "red" (deep brownish drab) shale there are small, spiral bodies resembling the tubes of *Spirorbis*. They occur in groups scattered on surfaces of uncertain nature, or sometimes shells. They occur about half immersed in the matrix, or somewhat deeper.

The spiral is in one plane. The largest individuals measure 2 mm. About one and a half turns seem to be present, but only the last is clearly seen. This increases in width rather slowly, always in clockwise direction. The surface of the spiral shows sculpture of weak, retractively radial folds on the lateral convexity, and there are also fine striae in the same direction. The tube appears to be oval in section, its periphery rounded.

From the uniform direction of coil it appears that the same side is always exposed, the under side probably being attached.

Locality: Shale, Little Conewago Creek (loc. 5).

Feeling some uncertainty about these fossils, a specimen was submitted to Dr. John M. Clarke, who reported as follows:

"I think there is little doubt that the specimen you have sent to me is *Spirorbis*. These tube-secreting worms show themselves to have been highly adaptable throughout Mesozoic and Paleozoic history. In the Carboniferous their tubes cover the leaves of coal plants and they are not unknown to us attached to terrestrial water-carried plants of the Devonian.

"This specimen before me carries the impression of a leaf or the interior of some thin-shelled mollusk which might well have been

washed out from the land into the brackish or salt waters and thus given the worm a chance for attachment. You will notice that with the coiled shells there are little ostracodes which are also indicative of brackish water conditions. It would be perfectly orderly to find this specimen in continental sediments."

EXPLANATION OF PLATES I-III.

PLATE I.—Figs. 1-17. Various forms of fish scales.

Figs. 18, 19. Coprolite, exterior and section.

PLATE II.—Fig. 1. *Diplodon pennsylvanicus* n. sp. Type.

Fig. 2. *Diplodon pennsylvanicus*. Dorsal view of an obliquely compressed specimen.

Fig. 3. *Diplodon pennsylvanicus*. Interior of another specimen.

Figs. 4, 5. *Diplodon carolus-simpsoni* n. sp. Type, dorsal and lateral views.

Fig. 6. *Diplodon carolus-simpsoni*. Lateral view of a larger specimen, in red shale.

PLATE III.—Fig. 1. *Mycetopoda diluculi* n. sp. Type, lateral view.

Figs. 2, 2a. *Diplodon yorkensis* n. sp. Type, dorsal and lateral views.

Fig. 3. *Spirorbis inexpectatus* n. sp. Type and paratypes.

Fig. 4. *Diplodon pennsylvanicus* n. sp.

Fig. 5. *Diplodon wanneri* n. sp. Type, lateral view.

NEW OR LITTLE-KNOWN CRANE-FLIES FROM THE AMAZONIAN REGION.

BY CHARLES P. ALEXANDER.

The crane-flies that inhabit the vast extent of the Amazonian basin are, unfortunately, still very insufficiently known. The pioneer collecting of Henry W. Bates has been supplemented in recent years principally by the work of Herbert S. Parish, whose two trips, in 1912 and in 1919-1920, have given us almost our sole knowledge of this remarkable fauna. The crane-flies collected on Parish's first trip have been recorded by the writer in other papers (1912-1914) that are cited in the bibliography at the end of the paper. The material secured on the second and more extended excursion has been discussed in part in three short papers by the writer (1920). Most of the new species secured on this trip, especially in the territory of the Upper Amazons, are reserved for consideration in the present paper. In order to complete the report, the comparatively few and scattered records of Amazonian Tipuloidea described in other papers are included herein. The types are in the collection of the writer; and paratypes of many of the species in the collection of the American Entomological Society.

Mr. Parish has kindly supplied the writer with a brief account of his trip which is recorded here to give a clear idea of the itinerary of the 1919-1920 excursion:

"I left New York on the 25th of May, 1919, and after a pleasant voyage of fourteen days arrived off the Brazilian coast. * * * The first place which I was to visit was the city of Pará, situated 175 miles up the Pará River, one of the tributaries of the Amazon. Pará or Belem is one of the finest cities in the tropics. Its parks and buildings are strictly up-to-date and it also boasts of having a completely equipped electric car-line. A branch of this line runs out to Waterworks, the first place where I collected on this trip. Here in the dense woods that surround the waterworks, and for miles around in this district, I collected many different species of insects, including numerous crane-flies. After remaining in this place for ten days, I travelled by railroad eastward to Igarapé-Assú and Pratá, where the collecting proved excellent, but great numbers of the insects collected were destroyed by ants and mold caused by the damp climate. From here I continued up the Amazon, my next stop being Santarem, about 400 miles from the coast. The forest here was scanty and the insects correspondingly scarce,

so I remained for only three days. The next stage of the journey was on a river steamer travelling to Obidos (Obydos, Bates). On board the steamer I was able to collect numbers of insects around the electric lights. The thick forest around Obidos is rich in game and insects are plentiful. It is what might be called a "Naturalist's Paradise." Here the largest of its genus, a tree-top flyer, *Morpho hecuba*, is found. To offset the pleasures of this paradise, mosquitoes are extremely bad both day and night. I left Obidos, travelling by night about 150 miles up the Trombetas River to a village called Oximinia, a small place with about 600 people, situated on the edge of the forest. This place is very secluded and rarely visited by naturalists. After ten days of good collecting I returned to Obidos. From Obidos I continued my way up the Amazon to Parintins and thence to the town of Itacoatiára (Itacoatiára or Serpa, Bates). I remained there for three weeks and then pushed on to Manáos (Barra or Manáos, Bates), a beautiful city situated on a hill. After collecting about the outskirts of this city for a few days, I moved on to a place called Flores, about ten miles out from Manáos on the electric line. Here I was successful in making a large catch of insects, many being new to science.

Teffé (Ega, Bates), about 300 miles up the Solimoes River, another of the main tributaries of the Amazon, was my next objective. The settlement here seemed to be almost the same as when Bates was here over sixty years ago, excepting the fine brick building erected by the Roman Catholics as a residence for their priests. The most striking thing to me was the luxuriance of the vegetation around Teffé Lake and the abundance of Micro-Lepidoptera and Diptera. While at Teffé I managed to ward off a severe attack of malaria which was threatening me. I stayed in this vicinity for two months and then boarded the steamer "Belem," travelling further up the Solimoes to Iquitos, in the Peruvian Department of Loreto. This trip required ten days. While on board the steamer I was able to catch a number of insects attracted to the electric lights at night. Landing at Iquitos, I found it to be a large, up-to-date city, not very far behind our northern cities. The forest about the place proved excellent for collecting. One day while walking in the forest, I noticed a hole in the side of a bank, apparently the entrance of some animal's burrow. By swishing my net about the entrance, I caught four or five crane-flies and later on found the same occurrence, the crane-flies representing one or two species. At this place, crane-flies were noted in numbers swarming in the sunlight. After two weeks' time, I caught a steam launch that plies between this place and Yurimaguas on the Huallaga River, a distance of some 550 to 600 miles. Here I lived with an Indian family who were very hospitable. Looming up in the west I could see the Andes Mountains. I procured a guide through my Indian host and took a walk into the forest. The air here seemed much fresher than that of the low-lying regions of the Amazonian Basin. I remained at Yurimaguas for about a month and then

returned to Iquitos. Here I accepted the invitation to accompany a prospector who was going up the Napo River. We left Iquitos at about three o'clock one afternoon in a small canoe. Our party consisted of five, including the Indian paddlers. The first night, after supper, I got out my collecting apparatus, consisting of a white sheet, lamp, cyanide bottles and net, and after fixing the sheet and lighting the lamp, I was ready for the insects. They started to come in twos and threes, but in about ten minutes they came so fast that I had to call my prospector friend to my assistance. Even then they were in such numbers that we could not get them all. It took me all of the next day to pin and paper this material. Each succeeding night while on the Napo River, I was able to add numerous specimens to my collection. The animal life, especially the birds and fishes, was extremely abundant. I was very sorry when the time came to leave this place and return to Iquitos. From here I caught the river steamer down the Amazon and returned to Canada after an absence of more than a year."

THE FACIES OF THE AMAZONIAN TIPULID FAUNA.

The known Amazonian crane-flies represent a comparatively large number of species distributed in a few relatively large genera. The tribes and subfamilies of the Tipulidae found here are the Limnobiini, Hexatomini, Eriopterini and Tipulinae. The families Tanyderidae, Ptychopteridae and Rhyphidae, and the Pediciini and Cylindrotominae of the Tipulidae, have not been discovered in Amazonian territory. The following genera are comparatively well represented in number of species: *Dicranomyia*, *Geranomyia*, *Rhipidia*, *Gonomyia*, *Erioptera*, *Gnophomyia*, *Trentepohlia*, *Psaronius*, *Polymera*, *Ozodicera* and *Brachypremna*. Other genera that are very characteristic of this general region, although more scantily represented in number of species, are as follows: *Rhamphidia*, *Diotrepha*, *Ceratocheilus*, *Toxorhina* and *Lecteria*. The following genera and subgenera appear to be confined to the Amazonian and Guianian sub-regions: *Molophilus* (*Eumolophilus*), *Ctenolimnophila*, and *Microtipula*. A few genera in the Amazonian region have been taken as yet only on the Upper Amazons in Peruvian territory; these are as follows: *Elephantomyia*, *Cryptolabis* and *Orimarga*.

Genus **GERANOMYIA** Haliday.

1833. *Geranomyia* Haliday, Ent. Mag., vol. 1, p. 154.

The very large and complex genus *Geranomyia* finds its center of distribution in the Neotropical Region. Many species are widely distributed but others seem to be rather local in their range, this

latter condition possibly being explainable in many instances by our still insufficient knowledge of tropical American Tipulidae.

***Geranomysia recondita* sp. n.**

Rostrum relatively short; head yellowish gray with a narrow silvery gray line extending the length of the vertex, behind the eyes bordered with dusky black; mesonotal praescutum ochreous, heavily striped with reddish brown to plumbeous brown; scutellum pale, pleura suffused with greenish; legs uniformly brown in color; wings yellowish gray with a relatively heavy brown and gray pattern, this including three conspicuous costal areas, the two largest at the origin of *Rs* and the stigma; *Sc* short, extending but a short distance beyond the origin of *Rs*.

Male.—Length (excluding rostrum) 7–7.2 mm.; wing 7–8.7 mm. rostrum about 3.3–3.4 mm.

Female.—Length (excluding rostrum) 7–7.5 mm.; wing 8.2–9.3 mm.; rostrum about 3.2 mm.

Rostrum relatively short, black. Antennae black. Head yellowish gray; a narrow median line of silvery gray extending the length of the vertex; on either side of this line, behind the eyes, a dusky black area. Mesonotal praescutum ochreous, heavily striped with darker; a narrow reddish brown median stripe that becomes obliterated before the suture; lateral stripes darker brown, sometimes plumbeous, behind the pseudosutural foveae broadly expanded laterad, behind crossing the suture onto the scutal lobes; median area of the scutum and the scutellum pale greenish white; postnotum with the median sclerite brownish plumbeous, the lateral sclerites pale. Pleura whitish, slightly pruinose, with very strong light green tints in fresh specimens. Halteres pale brown, the knobs darker. Legs with the coxae greenish testaceous; trochanters testaceous; remainder of the legs brown, the tarsi darker; the femora are unvariegated with other colors; claws small, at the base of each with a comb of four or five teeth that decrease in size toward the base. Wings with a yellowish gray tinge; cells *C* and *Sc* strongly yellowish; wings with a heavy brown and gray pattern, there being three conspicuous brown spots along the costal margin; one at the supernumerary crossvein in cell *Sc*, the second at the origin of *Rs* and tip of *Sc*, the third at the stigma; less distinct, gray, clouds and seams along the cord and outer end of cell *1st M*₂ and at the ends of veins *R*₂₊₃, *1st A* and *2nd A*; veins dark brown, yellow in the pale costal areas. Venation: *Sc* relatively short, *Sc*₁ ending a short distance beyond the origin of *Rs*, this distance about equal to *r*; *Sc*₂ at the tip of *Sc*₁; *Rs* long, gently arcuated; basal deflection of *R*₄₊₅ shorter than the basal deflection of *Cu*₁; cell *1st M*₂ long and narrow, longer than vein *M*₃ beyond it, about equal to vein *M*₁₊₂ beyond it; basal deflection of *Cu*₁ at or beyond the fork of *M*. Abdomen reddish brown, the sternites more greenish.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 6, 1920 (H. S. Parish).

Allotopotype, ♀.

Paratopotype, 2 ♀'s, May 6–25, 1920; paratypes, 8 ♂ ♀, Yurimaguas, April 6–22, 1920 (H. S. Parish).

***Geranomyia xanthoplaca* sp. n.**

Head dusky black; a narrow yellowish gray stripe extending from the front to the occiput; flagellar segments with long verticils; mesonotal praescutum orange-rufus, the lateral margins narrowly greenish; femora pale brown, the tips broadly pale yellow; a broad subterminal dark brown ring; wings faintly yellow; five conspicuous brown spots along the costal region, the third covering the origin of *Rs* and the tip of *Sc*, the latter short, extending but a short distance beyond the origin of *Rs*.

Male.—Length (excluding rostrum) about 4.8 mm.; wing 6 mm.; rostrum alone about 2.8 mm.

Female.—Length (excluding rostrum) about 4.6 mm.; wing 5.5 mm.; rostrum alone about 2.7–2.8 mm.

Rostrum black, comparatively short but slender. Antennae with the scapal segments black, the flagellum paler, dark brown; flagellar segments cylindrical or elongate-oval with long verticils in both sexes. Head with a conspicuous yellowish gray stripe extending from the front to the occiput, subequal in width to the space between the eyes at their narrowest point; remainder of the vertex and occiput dusky black. Mesonotal praescutum intense orange-rufous, without apparent darker stripes, the lateral margin narrowly greenish, the sublateral regions paler than the median stripe; remainder of the mesonotum yellowish testaceous, the posterior half of the postnotum darkened. In the female the scutal lobes are slightly darkened. Pleura yellow with greenish tints. Halteres pale, the knobs greenish brown. Legs with the coxae and trochanters greenish testaceous; femora pale brown, paler basally, the tips broadly (0.65 mm.) pale yellow; a broad subterminal dark brown annulus, this about equal in extent to the pale tip; the femora basad of this brown ring are narrowly and indistinctly yellowish; tibiae and tarsi greenish brown, the tips of the tibiae and distal tarsal segments darker; third and fourth tarsal segments with a series of fine comb-like bristles; claws with the basal shoulder indistinctly toothed. Wings with a faint yellowish tinge, the costal and subcostal cells brighter yellow; five conspicuous brown spots along the costal margin, arranged as follows: at arculus; at the supernumerary cross-vein in cell *Sc*; the third at the origin of *Rs* and tip of *Sc*₂; the fourth at the stigma, large and elongate; the last mark at the tip of *R*₂₊₃; large gray clouds at the ends of the anal veins; comparatively narrow gray seams along the cord and outer end of cell 1st *M*₂; veins yellow, brown in the infuscated areas. Venation: *Sc* short, *Sc*₁

extending but a short distance beyond the origin of R_s , Sc_2 close to the tip of Sc_1 ; R_s long, slightly angulated at origin; r more than its own length from the tip of R_1 ; cell 1st M_2 long and narrow, longer than any of the veins issuing from it; basal deflection of Cu_1 before to immediately beyond the fork of M . Abdominal tergites light brown, the sternites a little paler.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 6, 1920 (H. S. Parish).

Allotype, ♀, Yurimaguas, April 22, 1920 (H. S. Parish).

***Geranomyia bicincta* sp. n.**

Head dusky black; a narrow silvery gray stripe extending from the front to the occiput; flagellar segments with very long verticils; mesonotal praescutum orange, the lateral margins broadly pale brown, margined internally by a delicate gray line; femora obscure yellow, brightened at the end of the segment, the tip and a narrow subterminal ring dark brown; penultimate tarsal segment with a comb of about eight spines on the distal half; wings faintly yellowish with four small brown spots along the costa, the one at the origin of R_s separated from the one at the tip of Sc , the latter vein long, extending to beyond midlength of R_s .

Male.—Length (excluding rostrum) about 4.5 mm.; wing 5.8 mm., rostrum alone about 2.8 mm.

Female.—Length (excluding rostrum) about 6.8 mm.; wing 6.7 mm.; rostrum alone about 3.8 mm.

Rostrum moderately long and slender, brownish black. Antennae black, the distal flagellar segments a little paler; flagellar segments with unusually long verticils. Head with the vertex between the eyes narrow, silvery gray, this color continued caudad to the occiput; remainder of the vertex dusky black. Mesonotal praescutum orange, the lateral margins broadly pale brown; viewed from above these lateral margins appear much darker brown and there is a narrow silvery gray line between them and the orange disk; remainder of the mesonotum obscure yellowish. Pleura yellowish testaceous, the dorsal sclerites diffusely plumbeous. Halteres pale, the knobs brown. Legs with the coxae and trochanters testaceous; femora obscure yellow, the end of the segment brighter than the base, the extreme apex narrowly dark brown; a short distance from the tip is a narrow dark brown ring, this about equal in extent to the yellow subterminal ring; tibiae and tarsi brown; the penultimate and antepenultimate tarsal segments each bear a comb of spines on the inner face but that on the penultimate segment is here confined to the distal half of the segment and is composed of only about eight spines; terminal tarsal segment comparatively short and without a distinct comb; claws slender, the outermost of the teeth at the base of the claws produced into a long, hairlike point. Wings with a faint yellowish tinge, brighter in the costal and sub-

costal cells; four small brown spots along the costa, the first at the supernumerary crossvein in cell *Sc*; the second at the origin of *Rs*; the third at the tip of *Sc*; the last at the stigma; narrow and indistinct seams along the cord and outer end of cell 1st *M*₂; veins yellow, darker in the infuscated areas. Venation: *Sc* long, *Sc*₁ extending to about opposite two-thirds the length of the long *Rs*, *Sc*₂ at the tip of *Sc*₁; *Rs* long, slightly angulated at origin; cell 1st *M*₂ moderately long, about equal to vein *M*₁₊₂ beyond it; basal deflection of *Cu*₁ at the fork of *M*, subequal to *Cu*₂. Abdomen light brown; the sternites paler, brownish yellow.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 10, 1920 (H. S. Parish).

Paratopotype, ♂.

Geranomyia bicincta angusticincta subsp. n.

Male.—Length (excluding rostrum) about 5 mm.; wing 6.4 mm.; rostrum alone 3.5 mm.

Female.—Length (excluding rostrum) about 6.4 mm.; wing 6.1–6.3 mm.

In general resembling typical *bicincta*. Size slightly larger. Mesonotal praescutum, viewed from above, with indications of a pale brown median stripe. Femora without the darkened apices; terminal three segments of tarsi with a comb of spinous bristles, those on the penultimate segment including the entire length with the exception of a narrow space at base; ultimate segment with a comb on the distal half.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 10, 1920 (H. S. Parish).

Allotopotype, ♀.

Paratopotypes, 4 ♂ ♀, April 10–16, 1920; paratype, ♀, Iquitos, Peru, May 15, 1920 (H. S. Parish).

Geranomyia pilipes Walker.

1856. *Geranomyia pilipes* Walker, *Insecta Saundersiana*, vol. 1, Dipt., p. 440.

This species was described from the Amazonian Region. Mr. Edwards writes me that the type is not to be found in the British Museum collection. The species is notable by its unusual size (length 10 mm.; wing expanse 20 mm.).

Geranomyia separata sp. n.

Head dark brown, the pale line on the anterior part of the vertex not reaching the occiput; mesonotum reddish yellow, the praescutum with three narrow dark brown stripes; femora brownish yellow, the tips broadly light yellow with a narrow subterminal brown ring; wings grayish subhyaline, spotted with brown, the

spots at the origin of *Rs* and the tip of *Sc* separate; *Sc* rather long, extending to about one-third the length of *Rs*.

Male.—Length (excluding rostrum) about 6.4 mm.; wing 6.4 mm.

Female.—Length (excluding rostrum) 7.6 mm.; wing 8 mm.; rostrum alone 2.6 mm.

Rostrum black, in the male type broken, in the females relatively short. Antennae brownish black. Head dark brown, the vertex between the eyes more grayish, this color extending backward but not attaining the occiput. Mesonotal praescutum reddish yellow with three distinct narrow dark brown stripes; lateral margins of the praescutum infuscated; scutal lobes with the proximal margins dark brown, the median area and the scutellum whitish; postnotum dark brown, somewhat plumbeous. Pleura obscure yellow; the dorso-pleural region darker. Halteres pale brown, the knobs dark brown. Legs with the coxae and trochanters light yellow; femora pale brown, yellowish basally, darkening to beyond midlength, thence suddenly light yellow, at about midlength of this yellow tip with a narrow brownish black annulus; tibiae light brown, the tips blackened; tarsi light brown, passing into black at the tips. Wings grayish subhyaline, cells *C* and *Sc* more yellowish; a rather heavy brown pattern arranged as follows: Base of cell *Sc*; a broad seam on the supernumerary crossvein in cell *Sc*; a seam at the origin of *Rs*, continued some distance down the vein; an entirely separate seam at the tip of *Sc*; stigma large, subtriangular; cord and outer end of cell 1st *M*₂ seamed with brown; a cloud along vein 2nd *A* near its outer end. Venation: *Sc* rather long, *Sc*₁ extending some distance beyond the origin of *Rs*, about opposite one-third the length of *Rs*; *Rs* long, slightly angulated near origin; *r-m* short; cell 1st *M*₂ a little shorter than *M*₁₊₂ beyond it; basal deflection of *Cu*₁ just before the fork of *M*. Abdomen dark brown, the sternites paler.

Habitat.—Brazil, Peru.

Holotype, ♂, Yurimaguas, April 16, 1920 (H. S. Parish).

Allotopotype, ♀, April 12, 1920.

Paratype, ♀, Teffé, Brazil, January 9, 1920 (H. S. Parish).

The paratype from Teffé is larger and brighter colored than the allotype but undoubtedly pertains to this species. *Geranomyia separata* resembles *G. insignis* Loew and related species, but is readily told by the longer subcosta with the dark marking at the origin of *Rs* separate from that at the end of *Sc*.

***Geranomyia cinereinota* Alexander.**

1913. *Geranomyia cinereinota* Alexander, Ent. News, vol. 24, p. 407.

Teffé, Brazil, December 7, 1919, to February 4, 1920 (H. S. Parish).

Yurimaguas, Peru, April 5, 1920 (H. S. Parish).

Napo River, Peru, June 6-16, 1920 (H. S. Parish).

Genus **DICRANOMYIA** Stephens.

1829. *Dicranomyia* Stephens, Cat. Brit. Ins., vol. 2, p. 243.

In the territory of the Brazilian Amazons, species of the genus *Dicranomyia* appear to be very uncommon both as regards species and individuals. In Peruvian territory, however, they become more numerous.

Dicranomyia capnora sp. n.

Antennae dark brown, the first scapal segment white; front and anterior part of the vertex silvery-white pubescent; vertex with a conspicuous conical tubercle; mesonotum yellowish orange, the lateral margins darkening into clove-brown; legs pale testaceous yellow, the tarsi and tips of the tibiae white; wings deep smoky, the costal and apical regions more intense; a narrow dark pattern along the cord, outer end of cell *1st M*₂ and origin of *Rs*; *Sc* long.

Male.—Length 5.5-6.5 mm.; wing 7.7-8.3 mm.

Female.—Length 6.6 mm.; wing 7.8 mm.

Rostrum and palpi brownish black. Antennae with the first segment of the scape silvery-white; remainder of the antennae dark brown; the flagellar segments in the male are long-cylindrical, each with a short basal pedicel that is paler than the rest of the segment. Head moderately broad; front and anterior part of the vertex pure silvery-white; remainder of the head dark brown; vertex produced into a conspicuous conical elevation that is directed dorsad and slightly caudad. Mesonotal praescutum with the broad median area conspicuous yellowish orange, gradually darkening into clove-brown on the lateral margins of the sclerite; median area of the scutum and the scutellum yellowish orange, the lateral areas darker; postnotum pale brown. Pleura testaceous yellow. Halteres dark brown. Legs with the coxae and trochanters light yellow; femora and tibiae pale testaceous yellow, the apex of the tibiae and the tarsi excepting the terminal segment white; last tarsal segment and the claws blackish. Wings with a strong smoky tinge, more intense along the costal and apical regions; the basal, posterior and anal cells sometimes with paler centers; a sparse darker brown pattern, these spots arranged as follows: at origin of *Rs*; tip of *Sc*; *r*; along the cord and outer end of cell *1st M*₂; veins dark brown. Venation: *Sc* long, extending to beyond midlength of the long *Rs*, *Sc*₂ at the tip of *Sc*₁; *Rs* strongly angulated to slightly spurred at origin; deflection of *R*₄₊₅ about equal to the basal deflection of *Cu*₁; cell *1st M*₂ closed, comparatively short; basal deflection of *Cu*₁ close to the fork of *M* but slightly variable in position, longer than *Cu*₂. Abdominal tergites dark brown, the sternites and hypopygium more yellowish brown. Male hypopygium with the dorsal pleural

appendage a rather stout, almost straight, flattened hook with the tip slightly curved; ventral pleural appendage an oval flattened lobe, the inner face produced proximad into a flattened glabrous lobe, the tip with a few delicate setae. Gonapophyses appearing as broad flattened plates with the outer proximal angle narrowed into a point. Ovipositor with the valves very short, the tergal valves slender, acicular, strongly curved; sternal valves compressed, the tips subacute.

Habitat.—Peru.

Holotype, ♂, Napo River, June 12, 1920 (H. S. Parish).

Allotopotype, ♀, June 16, 1920.

Paratopotypes, 6 ♂'s, June 12–14, 1920; paratype, ♀, Yuriaguas, March 31, 1920 (H. S. Parish).

Dicranomyia capnora is a striking species that finds its closest relative in *D. lutzi* Alexander (British Guiana) from which it differs in the details of coloration of the body, wings and legs.

Dicranomyia optabilis sp. n.

Antennae dark brown; head yellowish gray; mesonotal praescutum reddish with a broad black median stripe; postnotum, scutellum and lobes of the scutum dark brown; pleura yellow and dark brown; halteres yellow; fore coxae dark brown; hind coxae yellow; femora brownish yellow with a very broad black subterminal ring; wings yellowish, the basal quarter and a conspicuous seam along the cord brownish; vein Sc long; abdominal segments dark brown, the distal half of each segment yellowish.

Female.—Length 6.6 mm.; wing 7.5 mm.

Rostrum and palpi dark brown. Antennae dark brown, the flagellar segments cylindrical, each with a short pedicel. Head dark, yellowish gray pruinose. Mesonotal praescutum shiny reddish castaneous with a broad black median stripe; lateral stripes short, confluent with the posterior ends of the median stripe; a large circular brown spot on the posterior margin of the sclerite; scutal lobes shiny brownish black, the median area paler; postnotum and the median area of the scutellum black, the lateral portions pale. Pleura with the propleura, mesosternum, mesepisternum and the lateral sclerites of the postnotum shiny dark brown; remainder of the pleura yellowish. Halteres yellow, the outer portion of the stem a little darkened. Legs with the fore coxae dark brown; middle coxae slightly infuscated; hind coxae yellowish; trochanters obscure yellow; femora brownish yellow, before the tips passing into a broad black subterminal ring, the extreme apices very narrowly obscure yellow; remainder of the legs black, the bases of the tibiae a little paler. Wings with a yellowish tinge, variegated with brown; stigma oval, dark brown; a broad basal crossband, slightly paler brown than the stigma, occupies more than the basal quarter of the wing; a broad brown seam along the

cord, tip of *Sc* and origin of *Rs*, broader and more diffuse posteriorly; wing-tip and a faint seam along the outer end of cell 1st *M*₂ faintly darkened; veins yellow, brown on the infuscated areas. Venation: *Sc* long, *Sc*₁ extending to about opposite two-thirds the length of *Rs*, *Sc*₂ at the tip of *Sc*₁; *Rs* rather short, angulated and slightly spurred at origin, inner end of cell 1st *M*₂ and *m* slightly arcuated; basal deflection of *Cu*₁ just beyond the fork of *M*. Abdominal segments with the basal half of each dark brown, the apical half yellowish. Ovipositor with the tergal valves slender, strongly up-curved, the tips acute; sternal valves long, terete, tapering gradually to the subacute apices.

Habitat.—Peru.

Holotype, ♀, Napo River, June 15, 1920 (H. S. Parish).

Dicranomyia eiseni (Alexander)

1912. *Furcomyia eiseni* Alexander, Can. Ent., vol. 44, pp. 338, 339.

Igarapé Assú, Brazil, July 14, 1919 (H. S. Parish).

Manãos, Brazil, November 4, 1919 (H. S. Parish).

Dicranomyia amazonica Alexander.

1920. *Dicranomyia amazonica* Alexander, Journ. N. Y. Ent. Soc., vol. 28, pp. 2, 3.

Igarapé Assú, Brazil, July 16, 1919 (H. S. Parish); Type.

Obidos, Brazil, September 10, 1919 (H. S. Parish).

Dicranomyia egae sp. n. Plate IV, fig. 10.

Antennae brownish black, flagellar segments cylindrical, short-petiolate; mesonotal praescutum brownish yellow with a very broad shiny black stripe; legs dark brown, the bases of the femora yellowish; wings brownish gray; *Sc* long; abdomen dark brown; male hypopygium highly complicated in structure.

Male.—Length 6.4 mm.; wing 6 mm.

Female.—Length 6.8 mm.; wing 6.4 mm.

Rostrum and palpi brownish black. Antennae brownish black throughout; flagellar segments oval to cylindrical, each with a short basal petiole. Head dark brown. Pronotum yellowish, black medially. Mesonotal praescutum brownish yellow with a single, very broad shiny black stripe that widens out strongly behind, suffusing the scutal lobes; extreme lateral margin of the praescutum with a brownish spot; median area of the scutum yellowish; scutellum dark brown, narrowly margined caudally with pale; postnotum dark brown. Pleura obscure yellow, the mesepisternum largely dark brown. Mesosternum brownish. Halteres yellow, the knobs dark brown. Legs with the coxae and trochanters light yellow; remainder of the legs dark brown, the femoral bases yellowish, narrowest on the fore legs, broadest on the posterior legs; claws slender with no teeth except at the base. Wings brownish gray, the costal region and the apex indistinctly darkened; stigma slightly darker brown,

ill-defined; veins brown. Venation: Sc long, ending just before the fork of the long sector, Sc_2 at the tip of Sc_1 ; R_s long, almost straight; r at the tip of R_1 ; basal deflection of R_{4+5} about twice $r-m$; cell 1st M_2 pentagonally rectangular, a little longer than vein Cu_1 beyond it; basal deflection of Cu_1 just before the fork of M , longer than Cu_2 alone. Abdomen dark brown, the ninth segment paler; hypopygium with the pleurites dark reddish brown, the appendages blackened. Male hypopygium (Plate IV, fig. 10) large and highly complicated in structure; pleurites cylindrical with two pleural appendages; the outer of these is a small, brown, clavata lobe that is provided with a few long bristles; the inner or apical pleural appendage is large, roughly triangular, the cephalic angle produced into a conspicuous claw-like hook; along the caudal margin there is a comb of about 30 slender teeth; proximal face of this lobe produced into a short, blunt, blackened lobe. On the proximal face of the pleurite near the base is a short cylindrical lobe capped by a brush of very long yellowish bristles, the inner (cephalic) ones shortest, the outer ones very long and conspicuous; basad of the pleurite is a larger but somewhat similar lobe, the apical tuft of hairs very dense but short, not exceeding the lobe in length.

Habitat.—Brazil.

Holotype, ♂, Teffé, December 20, 1919 (H. S. Parish).

Allotopotype, ♀.

Paratopotypes, 2 ♂'s.

Dicranomyia napoensis sp. n. Plate IV, fig. 11.

Male.—Length about 5 mm.; wing 5 mm.

Generally similar to *D. egae* sp. n., differing as follows: Size smaller. Praescutal stripes confluent as in *egae*. Wings a little broader, more grayish than brown, with the stigma more clearly defined, oval, brown; Sc shorter, cell 1st M_2 longer and narrower. Male hypopygium (Plate IV, fig. 11) with the setigerous lobes on the proximal face of the pleurites different in form; the basal lobe is elongate-cylindrical, darkened, bearing a rather short tuft of bristles at the apex; immediately caudad of this is a smaller lobe, paler, with the bristles of proportionately equal length. Near mid-length of the proximal face of the pleurite is a small cylindrical lobe bearing two very powerful flattened bristles or fascicles of bristles; at the base of this lobe is a larger one with a powerful bristle at its tip, the apex with abundant smaller bristles. The pleural appendage has the comb-like teeth very irregular in size and distribution, not evenly spaced as in *egae*. Gonapophyses flattened, the apices appearing as slender, erect, slightly curved pale blades.

Habitat.—Peru.

Holotype, ♂, Napo River, June 15, 1920 (H. S. Parish).

Dicranomyia rapax sp. n. Plate IV, fig. 12.

Head dark grayish pruinose; mesonotum reddish yellow, unmarked with darker; wings with Sc long; male hypopygium with

the pleural appendage powerful, shaped somewhat like the head and neck of a bird of prey.

Male.—Length about 5 mm., wing 6 mm.

Rostrum and palpi dark brown. Antennal scape dark brownish black, flagellum broken. Head dark, gray pruinose. Mesonotum light reddish yellow, the praescutum and scutum unmarked with darker as in the three other species of this group described at this time. Pleura yellowish testaceous, the dorsal sclerites a little darker. Halteres brown. Legs with the coxae and trochanters pale testaceous, remainder of the legs brown, the femora paler basally. Wings with a brownish tinge; stigma oval, darker brown; veins dark brown. Venation: *Sc* long, *Sc*₁ ending far beyond midlength of *Rs*, *Sc*₂ near the tip of *Sc*₁; basal deflection of *Cu*₁ some distance before the fork of *M*, this distance slightly variable. Abdomen dark brown, the sternites paler. Male hypopygium (Plate IV, fig. 12) very distinct from the other species of the group; pleurites very short and stout, on the proximal face near the base with a very stout lobe that is slightly enlarged and bifid at its outer end and here provided with several powerful bristles. Pleural appendage very large and powerful, shaped somewhat like the head of a bird of prey, the short curved apex being the beak, the neck region provided with dense acute spines. Gonapophyses appearing as flattened blades, the lateral angles produced laterad into a conspicuous cylindrical lobe, the apex blackened.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 6, 1920 (H. S. Parish).

Paratopotype, ♂, March 31, 1920.

Dicranomyia acuminata sp. n. Plate IV, fig. 9.

Antennae black, the flagellar segments provided with an apical pedicel; head dark, yellowish gray pruinose; mesonotal praescutum reddish yellow with three dark brown stripes that are not confluent; wings with *Sc* long; male hypopygium with the pleural appendage produced proximad into a long, tapering point.

Male.—Length 5 mm.; wing 6.1 mm.

Female.—Length 6.2 mm.; wing 6 mm.

Rostrum and palpi dark brown. Antennae rather long for a member of this genus, black; each flagellar segment with a moderately long apical pedicel; flagellar segments covered with a conspicuous white pubescence, the pedicels glabrous. In the female, the antennae are shorter, the flagellar segments without the apical pedicels. Head dark, yellowish gray pruinose. Pronotum reddish yellow, dark brown medially. Mesonotal praescutum reddish yellow with three conspicuous dark brown stripes, the median one becoming obliterated far before the suture; scutum obscure reddish, the lobes dark brown; remainder of the mesonotum dark brown. Pleura obscure reddish brown, sometimes a little darker. Halteres dark

brown. Legs with the coxae and trochanters yellowish testaceous; remainder of the legs brownish black, the femoral bases paler. Wings with a distinct brownish tinge; stigma small, subcircular, slightly darker brown; veins dark brown. Venation: *Sc* long, *Sc*₁ extending to some distance beyond midlength of *Rs*, *Sc*₂ close to the tip of *Sc*₁; *Rs* rather long, gently arcuated; *r* at the tip of *R*₁; basal deflection of *R*₄₊₅ about equal to or longer than the basal deflection of *Cu*₁; cell 1st *M*₂ closed, shorter than the veins beyond it; basal deflection of *Cu*₁ just beyond the fork of *M*. In the allotype, cell 1st *M*₂ is a little longer; basal deflection of *Cu*₁ just before the fork of *M*. Abdominal tergites dark brown; sternites pale obscure yellow; hypopygium yellowish. Male hypopygium (Plate IV, fig. 9) with the pleurites rather stout, provided with rather sparse long bristles; near the inner distal angle with about four shorter but powerful bristles in alignment; pleural appendage with the proximal end drawn out into a long acuminate point that is strongly curved near the outer end; this point is provided with a few delicate setae; closely applied to this pleural appendage but possibly representing a second appendage is a small blackened beak with four or five points, the whole suggesting a cock's-comb. Gonapophyses appearing as flattened blades, the tips slightly blackened and curved laterad.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 10, 1920 (H. S. Parish).

Allotype, ♀, Iquitos, May 12, 1920 (H. S. Parish).

Paratopotype, ♂, April 16, 1920; paratype, ♂, Iquitos, May 19, 1920.

Dicranomyia fumosa (Alexander)

1912. ? *Furcomyia fumosa* Alexander, Can. Ent., vol. 44, p. 364.

Napo River, Peru, June 12, 1920 (H. S. Parish).

Genus **RHIPIDIA** Meigen.

1818. *Rhipidia* Meigen, Syst. Besch., vol. 1, p. 153.

Four species of this genus have been taken within the Amazonian Region but there are doubtless many others yet to be discovered.

Rhipidia (Rhipidia) perarmata sp. n.

Antennae of the male long, bipectinate, bicolorous; head dark; mesonotal praescutum reddish brown with a darker median stripe; pleura dark brown; femora brown with a narrow darker subterminal ring; wings brownish gray; sparsely variegated with darker brown and subhyaline; *Sc* long; abdomen annulated reddish brown and dark brown; male hypopygium complicated in structure.

Male.—Length about 5.6 mm.; wing 6.5 mm.

Rostrum and palpi dark brown. Antennae of the male elongate, bipectinate; flagellum badly injured by insect pests; pectinations

very long and slender, much longer than the segments that bear them; between the bases of the pectinations a small hairy tubercle; the first flagellar segment apparently bears pectinations but this is uncertain, as this part of the organ is badly injured by pests; scapal segments dark brown, flagellar segments with the basal swelling and pectinations dark brown, the elongate terminal pedicel of each segment conspicuously ivory-white to produce a bicolourous appearance. Head dark grayish brown, the eyes practically contiguous on the vertex. Mesonotal praescutum dull reddish brown with a broad darker brown median stripe and very indistinct and abbreviated lateral stripes; remainder of the mesonotum dark brownish testaceous. Pleura dark brown, sparsely pruinose; sternites beneath obscure yellow. Halteres light yellow, the knobs broken. Legs with the coxae dark brown on the basal half of the outer face, the apical half suddenly pale yellow; trochanters yellow; femora brown, paler basally, the tips broadly and indistinctly paler and including a narrow brown subterminal ring; tibiae and tarsi dark brown. Wings with a strong brownish gray tinge, sparsely variegated with dark brown and subhyaline; cell *Sc* yellowish; the dark brown areas appear as clouds at the origin of *Rs*, tip of *Sc*, along the cord, outer end of cell 1st *M*₂ and at the stigma; wing-apex darkened; the subhyaline areas occupy the radial cells before the origin of *Rs*, most of cell 1st *R*₁, cell 2nd *R*₁ beyond the stigma; in cell *R*₃ one before and one beyond the level of *r*; veins dark brown. Venation: *Sc* long, *Sc*₁ extending to about opposite two-thirds the long *Rs*, *Sc*₂ near the extreme tip of *Sc*₁; *Rs* long, strongly arcuated at origin; *r* at the tip of *R*₁; *r-m* about one-half the basal deflection of *M*₁₊₂; cell 1st *M*₂ long and narrow, rectangular, about equal to vein *M*₃ beyond it; basal deflection of *Cu*₁ just beyond the fork of *M*. Abdomen reddish brown, the apical two-fifths of each segment dark brown. Male hypopygium very large and complicated in structure; pleurites small, about as large as the ventral pleural appendages, the proximal face produced inward into a cylindrical dark brown arm that is fringed with bristles along the cephalic face; the caudal face bears near midlength a tubercle tipped with two long bristles. Ventral pleural appendage fleshy, the proximal face produced inward as a yellow, slightly curved arm that bears two slender spines beyond midlength on the caudal face, these spines with the tips squarely truncated. Dorsal pleural appendage a long, cylindrical, slightly curved arm with the tip suddenly narrowed and acute. Gonapophyses flattened pale blades, the proximal angles produced caudad into narrow knife-like blades that are blackened at their tips. What appears to be the anal tube is very large, blackened, narrow basally, expanded into a conical structure apically, the margin crenulated.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 1, 1920 (H. S. Parish).

Rhipidia perarmata is related to *R. calverti* Alexander (Costa Rica) and *R. bipectinata* Williston (Lesser Antilles) but differs strik-

ingly in the coloration and very peculiar structure of the male hypopygium.

Rhipidia (Conorhipidia) punctipennis Alexander.

1914. *Rhipidia (Conorhipidia) punctipennis* Alexander, Journ. N. Y. Ent. Soc., vol. 22, pp. 117, 118.

A large female which may represent a new race of this species was taken at Iquitos, Peru, May 15, 1920 (H. S. Parish). The typical form has not been found outside of Costa Rica.

Rhipidia (Arhipidia) annulicornis Enderlein.

1912. *Rhipidia annulicornis* Enderlein, Zool. Jahrb. Syst., vol. 32, pp. 80, 81.

Sex? Napo River, Peru, June 8, 1920 (H. S. Parish).

Rhipidia (Arhipidia) domestica amazonensis Alexander.

1912. *Rhipidia domestica amazonensis* Alexander, Bull. Brooklyn Ent. Soc., vol. 8, p. 17.

Teffé, Brazil, December 25, 1919 (H. S. Parish).

Napo River, Peru, June 9-15, 1920 (H. S. Parish).

Rhipidia (Arhipidia) domestica angustifrons Alexander.

1912. *Rhipidia domestica angustifrons* Alexander, Bull. Brooklyn Ent. Soc., vol. 8, pp. 16, 17.

Napo River, Peru, June 9-12, 1920 (H. S. Parish).

The pectinations on the male antennae are distinctly longer than in typical *domestica*.

Genus **RHAMPHIDIA** Meigen.

1830. *Rhamphidia* Meigen, Syst. Besch., vol. 6, p. 281.

Rhamphidia miranda sp. n.

General coloration reddish yellow; wings grayish subhyaline with a conspicuous brown band along the cord; cell R_1 long and narrow; cell 1st M_2 rectangular, the basal deflection of Cu_1 beyond the fork of M ; male hypopygium with the shortest pleural appendage produced into a simple curved hook.

Male.—Length about 5.5 mm.; wing 5.2-5.6 mm.

Female.—Length 6.7 mm.; wing 5.4 mm.

Rostrum about as long as the remainder of the head, pale brownish yellow; palpi short, dark brown. Antennae short, light brown; flagellar segments elongate-cylindrical with very long verticils. Head light gray. Mesonotum reddish yellow without markings. Pleura slightly darker. Halteres pale, the knobs brown. Legs with the coxae and trochanters reddish yellow; remainder of the legs pale testaceous, the terminal tarsal segments slightly darker. Wings grayish subhyaline, cells C and Sc more yellowish; stigma oval, brown, occupying the middle portion of cell R_1 and the distal end of cell Sc_1 ; from the stigma a broad but ill-defined band con-

tinues across the wing following the cord to the fork of *Cu*; wing-base and wing-tip very slightly darker than the ground-color; veins pale brown, more yellowish in the costal region, darker in the infuscated areas. Venation: *Sc*₁ ending a short distance beyond the fork of *Rs*, *Sc*₂ at the tip of *Sc*₁; *Rs* straight, in alignment with the basal deflection of *R*₄₊₅; cell *R*₁ very long, the sides parallel; *r-m* distinct, about one-half of *m*; cell 1st *M*₂ rectangular, a little longer than vein *Cu*₁ beyond it; basal deflection of *Cu*₁ about one-half to its full length beyond the fork of *M*. Abdomen reddish brown, with a black subterminal ring on segments seven and eight. Male hypopygium with the shortest pleural appendage with the tip blackened, produced into a simple curved hook; in *R. mirabilis* the extreme tip is bifid.

Habitat.—Brazil, Peru.

Holotype, ♂, Teffé, Brazil, February 3, 1920 (H. S. Parish).

Allotype, ♀, Yurimaguas, Peru, April 6, 1920 (H. S. Parish); condition fragmentary.

Paratopotypes, 2 ♂'s, mounted in balsam; paratypes, 2 ♀'s, with the allotype, April 5 and 6, 1920; badly injured by insect pests; ♂, with the allotype, April 23, 1920.

Rhamphidia miranda bears a strong superficial resemblance to *R. mirabilis* Alexander but differs in the coloration and venation of the wings and in the details of structure of the male hypopygium.

***Rhamphidia mirabilis* Alexander.**

1914. *Rhamphidia mirabilis* Alexander, Trans. Am. Ent. Soc., vol. 40, pp. 230, 231.

Pratá, Brazil, July 5, 1919 (H. S. Parish).

Igarapé Assú, Brazil, July 15, 1919 (H. S. Parish).

Yurimaguas, Peru, April 6, 15, 17, 1920 (H. S. Parish).

Napo River, Peru, June 16, 1920 (H. S. Parish).

***Rhamphidia sanguinolenta* sp. n.**

General coloration light reddish yellow; head gray; mesonotal postnotum and a dorsal longitudinal pleural stripe dark brown; legs yellow, the femora narrowly tipped with dark brown; wings pale yellow; stigma oval, dark brown; two pale brown crossbands; wing-tip indistinctly darkened; basal section of *M*₁₊₂ long, oblique, the inner end of cell 1st *M*₂ being strongly arcuated; abdominal tergites annulated dark brown and obscure yellow.

Male.—Length 4.8 mm.; wing 4.5 mm.

Female.—Length 5 mm.; wing 4.6 mm.

Rostrum about as long as the head, light yellow; palpi pale brown. Antennae short; scapal segments yellow; flagellum pale brown. Head gray. Mesonotal praescutum light reddish yellow, the post-

notum dark brown. Pleura pale testaceous yellow, the dorsal pleurites with a brown longitudinal stripe, extended caudad to the postnotal region. Halteres light yellow. Legs with the coxae and trochanters pale yellow, the margins of the latter narrowly dark brown; femora yellow, the tips narrowly but distinctly dark brown; tibiae and tarsi pale yellow. Wings with a pale yellowish tinge; stigma oval, dark brown, conspicuous; much paler brown crossbands arranged as follows: Just beyond the base of the wing, beginning in cell *M*, continued to the anal margin at the end of vein *2nd A*; an ill-defined band along the cord; outer end of cell *1st M*₂ seamed with darker; wing-apex in cells *R*₃, *R*₅ and *2nd M*₂ indistinctly darkened; veins yellow, more brownish in the infuscated areas. Venation: *Sc*₁ ending at about opposite four-fifths *Rs*, *Sc*₂ a short distance from its tip; *Rs* short, gently sinuous to almost straight; *R*₂₊₃ relatively short, about equal to or approximately a fifth longer than *Rs*, gently bisinuous; *r-m* a little longer than the deflection of *R*₄₊₅; cell *1st M*₂ large, the proximal margin arcuated, oblique; basal section of *M*₁₊₂ longer than the second section, *r-m* being near mid-length of the cell *1st M*₂; *m* a little shorter than the outer deflection of *M*₃; basal deflection of *Cu*₁ at or close to the fork of *M*. Basal abdominal tergites annulated dark brown and obscure brownish yellow, the basal two-fifths of each segment being dark brown, the apical three-fifths brownish yellow; sternites yellow.

Habitat.—Peru.

Holotype, ♂, Iquitos, March 2, 1920 (H. S. Parish).

Allotopotype, ♀, March 5, 1920.

Paratopotypes, 2 ♂'s, March 4, 1920.

***Rhamphidia uniformis* Alexander.**

1914. *Rhamphidia uniformis* Alexander, Trans. Am. Ent. Soc., vol. 40, p. 230.

Pratá, Brazil, June 30, 1919 (H. S. Parish).

Teffé, Brazil, January 28, 1920 (H. S. Parish).

Napo River, Peru, June 4–15, 1920 (H. S. Parish).

***Rhamphidia albitarsis* Osten Sacken.**

1887. *Rhamphidia albitarsis* Osten Sacken, Berl. Ent. Zeitsch., vol. 31, p. 184.

Yurimaguas, Peru, March 31–April 22, 1920 (H. S. Parish).

A variety of *R. albitarsis* with the white of the fore and middle tarsi very narrowly restricted was taken at Iquitos, Peru, May 6, 1920 (H. S. Parish).

Genus **ORIMARGA** Osten Sacken.

1859. *Orimarga* Osten Sacken, Mon. Dipt. N. Amer., part 4, p. 120.

***Orimarga pallidibasis* sp. n.**

General coloration brown, grayish pruinose; pleura with a dark brown longitudinal stripe; legs with the tibiae and tarsi white, the

femora and tibiae broadly tipped with black; wings faintly grayish, the costal region slightly infuscated; wing-base conspicuously pale; distal section of R_1 longer than Rs .

Male.—Length about 5.5 mm.; wing 5.7 mm.

Female.—Length about 7 mm.; wing 6.4 mm.

Rostrum and palpi dark brown. Antennal scape dark brown, the flagellum broken. Head gray, clearer and lighter gray adjoining the inner margins of the eyes. Mesonotum gray pruinose, the median area broadly brownish, the extreme lateral margins narrowly whitish; remainder of the mesonotum brown, sparsely dusted with grey. Pleura brown, darker dorsally; sternum dark brown, paler medially beneath. Halteres pale. Legs with the coxae brownish testaceous; trochanters similar, the margin with a black spot; anterior femora whitish, the tips broadly and conspicuously blackened and with an indistinct whitish subterminal ring; posterior femora brown, gradually darkening to the black tips; tibiae white, the tips broadly and abruptly black; tarsi white. Wings with a faint greyish tinge, more brownish in the costal region; wing-base before the arculus conspicuously whitish; veins pale brown. Venation: Sc moderately long, Sc_1 ending opposite about three-fourths the length of Rs , Sc_2 rather indistinct, at the tip of Sc_1 ; Rs long, strongly arcuated at origin; r about mid-distance between Sc_2 and the tip of R_1 , the distal section of R_1 being a little longer than Rs ; $r-m$ shorter than the basal deflection of M_{1+2} ; petiole of cell M_3 longer than vein M_3 ; basal deflection of Cu_1 about its own length before the fork of M . Abdominal tergites dark brown, the sternites a little paler.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 8, 1920 (H. S. Parish).

Allotopotype, ♀, April 1, 1920.

Paratopotype, Sex ?, April 5, 1920.

Orimarga pallidibasis is readily told from the other known species of the genus by the position of the radial crossvein, vein R_1 beyond it being a little longer than the sector; in most species of the genus, r lies close to the tip of R_1 .

Genus **DIOTREPHA** Osten Sacken.

1878. *Diotrepha* Osten Sacken, Cat. N. Amer. Dipt., p. 219.

1888. *Thambeta* Williston, Synopsis N. Am. Dipt., p. 32.

Diotrepha atribasis Alexander.

1914. *Diotrepha atribasis* Alexander, Trans. Am. Ent. Soc., vol. 40, p. 240.

Flores, Brazil, November 18, 1919 (H. S. Parish).

Teffé, Brazil, December 22–24, 1919 (H. S. Parish).

Iquitos, Peru, June 7, 1920 (H. S. Parish).

Diotrepha fumicosta sp. n.

General coloration dark brown, legs pale yellow, wings brown, the costal margin broadly seamed with darker brown, basal deflection of Cu_1 about one-half the length of the sector before the origin of the latter.

Female.—Length 6.5 mm., wing 5 mm.

Rostrum and palpi dark brown. Antennae pale brown. Head brown. Mesonotum and pleura dark brown. Mesosternum slightly paler than the pleura. Halteres dark brown, the base of the stem paler. Legs with the coxae dark brown, trochanters obscure yellow; remainder of the legs pale yellow, only the terminal tarsal segments a little darkened. Wings with a strong brownish tinge, the costal region, continued to the wing-apex, broadly darker brown, this color paler on the basal third of the wing; a brownish cloud in the base of cell 1st A ; veins brown. Venation: Sc moderately long, Sc_1 ending opposite midlength of Rs , Sc_2 near the tip of Sc_1 ; Rs long, gently arcuated; r on R_2+3 and on R_1 , the distal section of R_1 being a little longer than the strongly arcuated basal deflection of R_4+5 ; basal deflection of Cu_1 before the level of the origin of Rs , the distance about one-half of Rs . In the paratype, Rs is considerably longer than R_2+3 . Abdomen dark brown, the stout valves of the ovipositor horn-colored. Tergal valves of the ovipositor much smaller and shorter than the powerful, blade-like sternal valves.

Habitat.—Brazil, Venezuela.

Holotype, ♀, Praté, Pará, Brazil, June 30, 1920 (H. S. Parish).

Paratopotypes, 2 ♀'s, one in the collection of the British Museum of Natural History.

Paratype, ♀, Boqueron, Yaracuy, Venezuela, March 17, 1920 (J. H. and E. B. Williamson and W. H. Ditzler).

The only described species with which the present form agrees at all is *D. concinna* Williston. Mr. F. W. Edwards, of the British Museum, has compared a paratype of the present species with Williston's types of *D. concinna* and reports the differences as follows:

"*D. concinna*: Thorax light brown. Wings clear (legs missing). Palpi longer. Wings narrower, especially cell Sc . Crossvein sc (Sc_2) beyond the tip of Sc , in one specimen another crossvein in cell Sc beyond the first. Rs half as long again as R_2+3 , hence all apical cells very short. $Cu_1 a$ (basal deflection of Cu_1) nearer base of wing, at a distance about equal to R_2+3 before base of Rs .

"*D. fumicosta*: Thorax darker brown. Wings with broad brown margin on apical part of costa. Palpi shorter. Wings rather broader. Crossvein sc just before tip of Sc . Rs a little shorter than R_2+3 , apical cells longer than in above. Distance of $Cu_1 a$ from base of Rs equal to less than half of R_2+3 ."—F. W. EDWARDS.

Although the remaining specimens of the type-series of *D. fumi-costa* do not agree in all particulars with the specimen described by Mr. Edwards, yet they are in so close agreement that practically all of the distinctions indicated hold throughout the series.

Genus **ATARBA** Osten Sacken.

1869. *Atarba* Osten Sacken, Mon. Dipt. N. Amer., part 4, pp. 127, 128.

Atarba is a rather small genus of crane-flies that reaches its greatest specific development in the tropics of the New World. The genus has been referred to the old tribe Antochini but the presence of tibial spurs in the typical forms would indicate that the present reference is more nearly correct despite the reduced venation.

***Atarba megaphallus* sp. n.**

Antennae of the male elongate; flagellum dark brown, both ends of each segment narrowly pale; wings grayish yellow; *Rs* short, cell 1st *M*₂ small; male hypopygium with the penis-guard greatly enlarged, the apex widened into a hood-shaped structure.

Male.—Length 5–5.5 mm.; wing 5–5.8 mm.

Female.—Length 6.5 mm.; wing 6.2 mm.

Rostrum brownish yellow. Antennae of the male elongated, longer than one-half the body; scapal segments brownish yellow; first flagellar segment pale brown, passing into dark brown before the tip, the extreme apex pale; remaining flagellar segments dark brown, the extreme base and apex of each segment pale to produce a narrowly annulated appearance; flagellar segments elongate-cylindrical, clothed with an abundant erect white pubescence and provided with a few verticils arranged unilaterally. Head pale brownish yellow. Mesonotum pale brownish yellow, the praescutum without markings. Pleura brown, fading into yellow on the sternum. Halteres pale brown, the knobs dark brown. Legs with the coxae and trochanters obscure yellow; femora obscure yellowish, the extreme tips indistinctly darker; remainder of the legs brownish yellow, only the terminal tarsal segments darker brown. Wings with a strong grayish yellow tinge, the stigmal region indistinctly darker; veins pale brownish yellow. Venation: *Sc* short, *Sc*₁ ending just beyond the origin of *Rs*; *Sc*₂ some distance from the tip of *Sc*₁, the latter alone being nearly equal to the short sector; *Rs* short, but little longer than the deflection of *R*₄₊₅; *R*₂₊₃ almost straight, running rather close to *R*₁; cell *R*₁ much narrower than *R*₃ at the wing-margin; cell 1st *M*₂ very small, pentagonal; basal deflection of *Cu*₁ beyond the fork of *M*. Abdominal tergites obscure yellowish brown; sternites clearer yellow; in the male a conspicuous subterminal blackish ring on segments five and six, hypopygium obscure yellow. Male hypopygium with the pleurites and appendages about as in the other species of the genus; penis-guard greatly enlarged, the apex widened and concave above, hood-like.

Habitat.—Brazil.

Holotype, ♂, Teffé, December 22, 1919 (H. S. Parish).

Allotopotype, ♀, December 25, 1919.

Paratopotypes, 2 ♂'s, with the type.

Genus **ELEPHANTOMYIA** Osten Sacken.

1859. *Elephantomyia* Osten Sacken, Proc. Acad. Nat. Sci. Phila., p. 220.

The genus *Elephantomyia* has long been referred to the tribe Antochini and later to the Eriopterini. The presence of distinct tibial spurs would indicate that this genus, like *Atarba*, is an aberrant hexatomine form.

Elephantomyia supernumeraria sp. n.

General coloration dark brown; thoracic pleura gray pruinose with two narrow dark brown longitudinal stripes; legs black; wings subhyaline with a heavy brown pattern; a supernumerary cross-vein near the outer end of cell R_2 .

Male.—Length (excluding rostrum) about 5.4 mm.; wing 5.8 mm.; rostrum about 3.9 mm.

Rostrum long and slender, dark brown. Antennae dark brown; verticils elongate. Head gray. Mesonotum dark brown. Pleura pale brown, sparsely pruinose, with two narrow dark brown longitudinal stripes, the dorsal stripe beginning at the cervical sclerites, extending beneath the wing-root; the ventral stripe begins on the mesosternum before the middle coxa, passing beneath the halter to the base of the abdomen. Halteres yellow, the knobs infuscated. Legs with the fore and middle coxae infuscated; posterior coxae less darkened; trochanters obscure yellow, the margin with a brown spot; remainder of the legs black, the bases of the femora narrowly pale; the joint between the femur and tibia is narrowly and indistinctly pale. Wings subhyaline with a heavy and conspicuous brown pattern, distributed as follows: At arculus; a large area at the origin of R_s , extending caudad to vein M ; a small spot at the tip of Sc_1 ; a conspicuous seam at the stigma, continued along the cord to the fork of M ; rounded spots at the tips of veins R_1 and R_2 , the latter extending onto the supernumerary crossvein in cell R_2 ; wing-tip infumed; brownish seams along the outer end of cell $1st\ M_2$ and the basal deflection of Cu_1 ; veins light brown, slightly darker in the infuscated areas. Venation: Sc long, Sc , extending to about opposite four-fifths the long R_s ; R_s strongly arcuated at origin; R_2 very short, a little less than m ; a supernumerary crossvein in cell R_2 near its outer end, the tip of vein R_2 beyond it pale and without macrotrichiae; cell $1st\ M_2$ large, rectangular, about as long as a little shorter than vein M_{1+2} beyond it; basal deflection of Cu_1 at or beyond midlength of cell $1st\ M_2$, a little longer than Cu_2 . Abdomen dark brown, the base of the hypopygium a little brighter. Male hypopygium with the two pleural appendages subequal in

length, the outer appendage more slender, at the tip split into two short, subequal points.

Habitat.—Peru.

Holotype, ♂, Napo River, June 8, 1920 (H. S. Parish).

Paratopotype, ♂.

Elephantomyia supernumeraria is distinguished from all the described American species of the genus by the heavily patterned wings and from all known species of the genus by the presence of a supernumerary crossvein in cell R_2 of the wings.

CTENOLIMNOPHILA gen. n.

Antennae with sixteen segments, the flagellar segments short-cylindrical. Tibiae provided with spurs. Wings with Sc_2 at the tip of Sc_1 ; a supernumerary crossvein in cell R_2 ; cell 1st M_2 very long and narrow, irregular in outline, approximately twice as long as the cells beyond it; cell M_1 lacking. Male hypopygium with the outer pleural appendage provided with very long, appressed teeth on the outer face before the tip.

Genotype.—*Ctenolimnophila bivena*, sp. n. (Amazonian Region).

The general appearance of the two species now known to belong to this genus is much more like a *Gnophomyia* than a Limnophiline form. *Gnophomyia decisa* Alexander, described from imperfect material, is now known to be a member of this genus. The tibial spurs in *C. decisa* are much shorter and stouter than in *C. bivena*. The type of hypopygium is strongly suggestive of *Ephelia* and *Atarba*.

Ctenolimnophila bivena sp. n.

Male.—Length 4.5 mm.; wing 4.8–5.3 mm.

Generally similar to *C. decisa* but differing in several important details. The general coloration is dark brown, the legs conspicuously light yellow. The hairs of the legs are longer and more outspreading than in *decisa*. The principal differences between the two forms are found in the wings, as follows:

Wings with a supernumerary crossvein in cell R_3 in addition to the one in cell R_2 , the former lying a short distance proximad of the latter. Wings more uniformly darkened, the radial cells uniformly dark brown, the cubital and anal cells grayish brown; narrow seams and spots at the origin of R_s , along the cord, outer end of cell 1st M_2 and the supernumerary crossveins darker brown; no indications of the three pale spots along the costal margin as in *decisa*; the only pale areas on the wing are the centers of cells 1st M_2 , 2nd M_2 , M_3 and a faint wash before the cord in the end of cell R .

Habitat.—Peru, Brazil.

Holotype, ♂, Napo River, Peru, June 22, 1920 (H. S. Parish).

Paratopotype, ♂; paratype, sex?, Teffé, Brazil, December 24, 1919 (H. S. Parish).

Ctenolimnophila decisa (Alexander)

1914. *Gnophomyia decisa* Alexander, Trans. Am. Ent. Soc., vol. 40, pp. 245, 246.

Pratá, Brazil, June 30, 1919 (H. S. Parish). This specimen differs in a few minor points from typical *decisa* but with the scanty material available it is impossible to separate the species.

Genus **LIMNOPHILA** Macquart.

1834. *Limnophila* Macquart, Suites à Buffon, Tome 1, Hist. Nat. Ins., Dipt., p. 95.

Limnophila (Limnophilella) epiphragmoides Alexander.

1913. *Limnophila epiphragmoides* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 543, 544.

Igarapé Assú, Brazil, January 30, 1912 (H. S. Parish); Type.

Limnophila diversipes sp. n.

General coloration brownish yellow; legs brown, the tips of the tibiae, bases and tips of the metatarsi and the remaining tarsal segments white; wings petiolate, the anal angle practically lacking; membrane hyaline, the tip slightly infuscated; petiole of cell M_2 very short; 2nd Anal cell long and narrow.

Sex?—Wing 9 mm.

Rostrum and palpi brown. Antennae broken. Head reddish brown, more yellowish caudally and on the genae. Mesonotum small, pale brownish yellow, unmarked. Pleura yellowish. Halteres broken. Legs with the coxae testaceous yellow; trochanters with a decided greenish tinge; femora brown; tibiae dark brown, the tips broadly (2.4 mm.) and abruptly snowy white; metatarsi brownish black, the extreme bases and the apical third to fifth snowy white, this color most extensive on the posterior legs; remainder of the tarsi white, the terminal segments tinged with greenish. Wings elongate, petiolate; anal angle practically lacking; membrane hyaline, the apex beyond cell 1st M_2 distinctly but faintly infuscated; stigma very small, oval, brown; veins dark brown. All the longitudinal veins beyond the cord with long, conspicuous macrotrichiae; R_s , M , Cu and the Anal veins likewise with macrotrichiae, smaller and more scattered toward the base of the wing. Venation: Sc long, Sc_1 extending to slightly beyond midlength of R_{2+3} , Sc_2 at the tip of Sc_1 ; R_s long, strongly angulated at origin; R_{2+3} almost in alignment with R_s , a little shorter than the distal section of R_2 ; r on R_2 at about three-fifths its length and on R_1 a little more than its length from the tip; basal deflection of R_{4+5} short, strongly arcuated, a little longer than the basal deflection of Cu_1 ; cell 1st M_2 long and narrow, rectangular; petiole of cell M_1 very short, less than m , cell M_1 consequently very deep; basal deflection of Cu_1 about one-third its length beyond the fork of M ; Cu_2 approximately four times the basal deflection of Cu_1 ; 2nd Anal vein long, running close to and parallel with the anal margin of the wing so that cell

2nd *A* is very long and narrow, widened distally; the two Anal veins run parallel for the greater part of the length of the 2nd. Abdomen broken.

Habitat.—Peru.

Holotype, Sex?, Yurimaguas, April 6, 1920 (H. S. Parish).

Genus **EPIPHRAGMA** Osten Sacken.

1859. *Epiphragma* Osten Sacken, Proc. Acad. Nat. Sci. Phila., p. 233.

Epiphragma fabricii Alexander.

1913. *Epiphragma fabricii* Alexander, Proc. U. S. Nat. Mus., vol. 44, p. 536.

Iquitos, Peru, March 9 to May 6, 1920 (H. S. Parish).

Yurimaguas, Peru, April 10, 1920 (H. S. Parish).

Epiphragma varia (Wiedemann)

1828. *Limnobia varia* Wiedemann, Aussereur. zweifl. Ins., Thl. 1, p. 573.

Teffé, Brazil, January 28, 1920 (H. S. Parish).

Yurimaguas, Peru, March 31, 1920 (H. S. Parish).

Napo River, Peru, June 16, 1920 (H. S. Parish).

Genus **PSARONIUS** Enderlein.

1912. *Psaronius* Enderlein, Zool. Jahrb., Abt. Syst., Bd. 32, H. 1, p. 50

Psaronius obscurus (Fabricius)

1805. *Tipula obscura* Fabricius, Syst. Antl., p. 27.

Igarapé Assú, Brazil, January 29, 1912, to February 4, 1912 (H. S. Parish).

Psaronius pallipes Alexander.

1920. *Psaronius pallipes* Alexander, Ent. News, vol. 31, p. 73.

Known only from the types, taken at Prata, Brazil, June 30 and July 5, 1919 (H. S. Parish).

Psaronius pygmaeus Alexander.

1914. *Psaronius pygmaeus* Alexander, Trans. Am. Ent. Soc., vol. 40, pp. 249, 250.

Obidos, Brazil, September 6, 1919 (H. S. Parish).

Yurimaguas, Peru, April 1, 1920 (H. S. Parish).

Psaronius trianguliferus sp. n.

General coloration yellowish brown, the mesonotal praescutum with three darker stripes, the lateral ones incurved to the median stripe at their anterior ends, femora with a narrow, dark brown subterminal ring, wings brownish yellow, the veins broadly seamed with grayish; cell 2nd *R*₁ elongate-triangular, veins *R*₁ and *R*₂ being subcontiguous at their distal ends.

Female.—Length about 16 mm.; wing 11.5 mm.

Rostrum and palpi dark brown. Antennae with the scapal segments obscure yellow, the basal segments of the flagellum brownish

yellow, passing into dark brown before the tip of the organ. Head obscure yellow with a delicate brown median line. Mesonotal praescutum yellowish brown with three darker brown stripes; median stripe pale anteriorly but becoming better defined toward the suture; lateral margins and a capillary median vitta darker brown; lateral stripes brown, their cephalic ends directed proximad, indistinctly confluent with the median stripe, isolating two pale submedian areas immediately before the suture; scutum brown, each lobe with a brownish yellow circle, enclosing a dark center; scutellum and postnotum brown. Pleura obscure yellow with a relatively narrow dorsal brown stripe; mesosternum also brown, these two dark areas enclosing between them an ill-defined longitudinal pale stripe. Halteres with the stem yellow, the knobs dark brown. Legs with the coxae and trochanters obscure yellow; femora yellowish, before the tips with a narrow, subterminal brown ring; tibiae yellow, the extreme bases narrowly infuscated, the tips narrowly dark brownish black; tarsi obscure yellow, the terminal segments slightly darker. Wings with a strong brownish yellow tinge, the costal cell more brownish, the subcostal cell clear yellow; darker brown clouds at the base of cell R ; at origin of R_s ; fork of R_s and at the stigma; all the veins are very broadly seamed with greyish, these seams restricting the ground-color to narrow longitudinal streaks; basal third of cell R_2 yellow, the distal two-thirds greyish; veins brown. Venation: Sc_1 ending immediately beyond r ; R_s long, strongly angulated at origin, a little longer than R_2+s ; R_2 subcontiguous with R_1 at costa so that cell 2nd R_1 has an elongate-triangular shape; petiole of cell M_1 a little shorter than the basal deflection of R_4+s ; m about one-half the outer deflection of M_s ; Cu_2 shorter than the basal deflection of Cu_1 . Abdominal tergites brown, each segment slightly paler basally; sternites yellow.

Habitat.—Peru.

Holotype, ♀, Yurimaguas, April 6, 1920 (H. S. Parish).

By means of the author's key to the species of the genus *Psaronius* (Trans. Amer. Ent. Soc., vol. 40, p. 250. 1914), *P. trianguliferus* runs out to couplet 3, both of the included species having the mesonotum practically unicolorous. From the more recently described *P. pallipes* Alexander (Brazil), the present species differs in the venation and the coloration of the tarsi.

***Psaronius mancus* sp. n.**

Mesonotal praescutum brownish yellow with three darker brown stripes, the median stripe with a capillary darker brown line that continues back to the base of the abdomen; femora with a narrow subterminal brownish black ring; tibiae light brown, the base and tip blackened; wings brownish yellow, the veins conspicuously seamed with brown; vein R_2 entirely lacking; cell M_1 shorter than its petiole.

Female.—Length 21–22 mm.; wing 14.2–15 mm.

Rostrum and palpi dark brown. Antennae short, the scape and first flagellar segment brownish yellow; remainder of the flagellum dark brown. Head brownish yellow, the dorso-median area of the vertex darker brown. Mesonotal praescutum brownish yellow with three darker brown stripes; median stripe with the lateral margins and a capillary median line still darker brown; pseudosutural foveae conspicuous; scutum dark brown, the median area with a capillary dark line; scutellum pale brownish testaceous with a narrow brown median line; postnotum pale brown, the median line darker. Pleura light brown, variegated with darker brown. Sternum light yellowish brown. Halteres dark brown, the base of the stem paler. Legs with the coxae light brown, dark brown basally; trochanters brownish yellow; femora brownish yellow, a narrow (0.6 mm.) brownish black subterminal ring, preceded by a broad but ill-defined yellowish ring, the apex narrowly pale; tibiae light brown, the tip and the slightly narrower base black; metatarsi light brown, the tips dark brown; remainder of the tarsi dark brown. Wings with a strong brownish yellow tinge; cell *C* brown, cell *Sc* yellowish; very broad brown clouds at the base of cell *R*, origin and fork of *Rs* and as conspicuous seams along the longitudinal veins, in cells *M*, 1st *A* and 2nd *A* suffusing most of the cells; veins dark brown, darkest in the clouded areas. Venation: vein R_2 entirely lacking as in *P. abnormis* Alexander and *P. brevitibia* Alexander; R_{2+3} considerably longer than the deflection of R_{4+5} ; $r-m$ longer than the basal deflection of M_{1+2} ; cell M_1 considerably shorter than its petiole; fusion of Cu_1 and M_3 slight; vein Cu_2 longer than the basal deflection of M_{1+2} ; 2nd *Anal* vein rather long, ending a trifle before the origin of *Rs*. Abdomen dark brown. Ovipositor with the valves comparatively short, blackened basally; tergal valves gently up-curved, their apices pale.

Habitat.—Brazil.

Holotype, ♀, Teffé, December 20, 1919 (H. S. Parish).

Paratopotype, ♀, December 12, 1919.

Psaronius mancus is readily told from all described species of the genus by the diagnostic characters given above. Its only close relative is *P. brevitibia* Alexander, likewise from the Amazonian Region.

Psaronius brevitibia Alexander.

1920. *Psaronius brevitibia* Alexander, Ent. News, vol. 31, p. 74.

Still known only from the type specimen, taken at Obidos, Brazil, August 28, 1919 (H. S. Parish).

Genus **POLYMERA** Wiedemann.

1821. *Polymera* Wiedemann, Dipt. Exot., p. 40.

Polymera includes nearly a score of species that are confined to tropical and subtropical America. The genus is abundantly rep-

resented in the Amazonian region, where it must be considered as being one of the most characteristic Tipulid genera.

***Polymera conjuncta* Alexander.**

1913. *Polymera conjuncta* Alexander, Proc. U. S. Nat. Mus., vol. 44, p. 529.

The types were taken at Igarapé Assú, Brazil, February 4, 1912 by H. S. Parish.

***Polymera conjunctoides* Alexander.**

1920. *Polymera conjunctoides* Alexander, Ent. News, vol. 31, pp. 74, 75.

Itacoatiára, Brazil, October 16, 1919 (H. S. Parish); Type.

Manáos, Brazil, October 31, 1919 (H. S. Parish).

Napo River, Peru, June 9-15, 1920 (H. S. Parish).

***Polymera parishi* Alexander.**

1920. *Polymera parishi* Alexander, Can. Ent., vol. 52, pp. 143, 144.

Manáos, Brazil, October 31-November 4, 1919 (H. S. Parish).

The above three species belong to the subgenus *Polymerodes* Alexander, in which the tibial spurs are quite lacking.

***Polymera pleuralis* Alexander.**

1913. *Polymera pleuralis* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 528, 529.

Igarapé Assú, Brazil, January 19-February 7, 1912 (H. S. Parish); Types.

Yurimaguas, Peru, April 1, 1920 (H. S. Parish).

***Polymera obscura* Macquart.**

1838. *Polymera obscura* Macquart, Dipt. Exot., Tome 1, pt. 1, p. 65.

Igarapé Assú, Brazil, January 19-February 4, 1912 (H. S. Parish).

Itacoatiára, Brazil, October 12-22, 1919 (H. S. Parish).

Teffé, Brazil, December 4-27, 1919 (H. S. Parish).

Iquitos, Peru, May 18, 1920 (H. S. Parish).

Yurimaguas, Peru, April 17, 1920 (H. S. Parish).

***Polymera thoracica* Alexander.**

1913. *Polymera thoracica* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 533, 534.

Known only from the type locality, Igarapé Assú, Brazil, February 7, 1912 (H. S. Parish).

***Polymera hirticornis* (Fabricius)**

1805. *Chironomus hirticornis* Fabricius, Syst. Antliat., p. 46.

Igarapé Assú, Brazil, January 23, 1912 (H. S. Parish).

Obidos, Brazil, September 10, 1919 (H. S. Parish).

***Polymera superba* Alexander.**

1913. *Polymera superba* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 530, 531.

Igarapé Assú, Brazil, January 24, 1912 (H. S. Parish).

Teffé, Brazil, December 24–26, 1919 (H. S. Parish).

***Polymera niveitarsis* Alexander.**

1913. *Polymera niveitarsis* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 532, 533.

Igarapé Assú, Brazil, January 29, 1912 (H. S. Parish).

Pratá, Brazil, June 30, 1919 (H. S. Parish).

Iquitos, Peru, May 11–15, 1920 (H. S. Parish).

Yurimaguas, Peru, April 7–10, 1920 (H. S. Parish).

***Polymera crystalloptera* sp. n.**

Close to *P. niveitarsis* Alexander; wings crystalline hyaline; *r* close to the tip of *R*₁; *r-m* before the fork of *R*_s.

Male.—Length 7.5–8.5 mm.; wing 6.5–7.5 mm.

Rostrum and palpi orange-yellow. Antennae of the male elongate, approximately as long as the body; scapal segments tumid, brownish orange; flagellar segments black, in structure quite as in *P. niveitarsis*, elongate-cylindrical, not constricted, provided with abundant erect black hairs. Head dark brown. Mesonotal praescutum reddish yellow with a broad reddish brown median stripe that is sometimes obliterated; scutum and scutellum reddish brown, the postnotum slightly paler. Pleura obscure reddish yellow. Halteres brown. Legs with the coxae and trochanters obscure yellow; femora dark brown, paler basally; tibiae and tarsi dark brown, posterior metatarsi with the apical half snowy white; remaining tarsal segments similar, only the terminal segment infuscated. Wings crystalline hyaline, highly iridescent; veins very conspicuous, brownish black. Venation: Arculus interrupted; *r* far out near the tip of *R*₁, the distal section of the latter vein from one to two times *r*; *r-m* connecting *R*_s immediately before the fork; basal deflection of *Cu*₁ before the fork of *M*, the distance about equal to *r*; cell *M*₁ small, vein *M*₂ being about equal to or shorter than the basal deflection of *Cu*₁; petiole of cell *M*₃ about two-thirds to three-fourths the cell. Abdominal tergites dark brown; basal sternites yellowish, becoming more obscure toward the tip of the organ; hypopygium pale brown, the appendages black.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 2, 1920 (H. S. Parish).

Paratopotype, ♂, April 8, 1920.

Genus **PENTHOPTERA** Schiner.

1863. *Penthoptera* Schiner, Wien. Ent. Monatsch., vol. 220.

***Penthoptera batesi* sp. n.**

Antennae of the male rather short; general coloration reddish yellow, the pleura testaceous yellow; tarsi white, this color including

all but the basal fifth of the posterior metatarsus; wings subhyaline, the wing-tip a little darker; cell M_1 lacking; basal deflection of R_4+5 distinct.

Male.—Length 9.2 mm.; wing 8.3 mm.

Rostrum obscure brownish yellow; palpi dark brown. Antennae of the male rather short, if bent backward extending about to the wing-root; scapal segments obscure yellow, the flagellum dark brown. Head brown, more grayish adjoining the margin of the eyes. Mesonotum reddish yellow without apparent darker stripes. Pleura testaceous yellow. Halteres brown. Legs with the coxae and trochanters testaceous yellow; remainder of the legs dark brown, the femoral bases paler; terminal tarsal segments snowy-white, on the fore legs including the apical fifth of the metatarsus; on the middle legs, the white includes a little less than the apical half; on the posterior legs, the white includes the apical four-fifths, the basal fifth being darkened. Wings subhyaline, cell Sc faintly darker; stigma very indistinct to practically lacking; apex of the wing beyond the level of r and the outer end of cell $1st\ M_2$ darkened. Venation: Sc long, Sc_1 ending a little beyond the level of $r-m$; Rs long, arcuated at origin; R_2+3 about two-fifths of Rs , in alignment with R_2 ; r on R_2 about the length of $r-m$ beyond the fork of R_2+3 , the distal section of R_1 being about twice r ; basal deflection of R_4+5 longer than r ; cell $1st\ M_2$ elongate-rectangular, about as long as vein M_{1+2} beyond it; cell M_1 lacking; basal deflection of Cu_1 a little less than half its length beyond the fork of M ; basal deflection of Cu_1 about equal to Cu_2 . Abdomen dark brown; sternites obscure yellow. Male hypopygium with the pleural appendages very long and slender.

Habitat.—Brazil.

Holotype, ♂, Teffé, January 28, 1920 (H. S. Parish).

Penthoptera batesi is dedicated to the memory of the great naturalist, Henry W. Bates, who spent more than four years at Teffé.

Genus **ERIOCERA** Macquart.

1838. *Eriocera* Macquart, Dipt. Exot., Tome 1, p. 74.

Eriocera macrocera Alexander.

1914. *Eriocera macrocera* Alexander, Psyche, vol. 21, p. 40.

This interesting crane-fly is still known only from the unique type, taken at Igarapé Assú, Brazil, January 30, 1912 (H. S. Parish).

Eriocera amazonicola Alexander.

1920. *Eriocera amazonicola* Alexander, Can. Ent., vol. 52, p. 144.

Manáos, Brazil, November 4, 1919 (H. S. Parish); Type.

Flores, Brazil, November 12, 1919 (H. S. Parish).

Genus **ERIOPTERA** Meigen.

1803. *Erioptera* Meigen, Illiger's Mag., Bd. 2, p. 262.

Species of the genus *Erioptera* are relatively abundant in the Amazonian Region. Many of these species belong to the subgenus *Mesocyphona* which reaches its greatest specific development in the Tropics of the New World. A few other forms belong to the typical subgenus *Erioptera*, although the species of the *annulipes* group must be considered as being somewhat aberrant.

Erioptera (Erioptera) micromyia Alexander. Plate IV, fig. 8.

1920. *Erioptera (Erioptera) micromyia* Alexander, Journ. N. Y. Ent. Soc., vol. 28, p. 8.

The type female was from Prata, Brazil, June 30, 1919 (H. S. Parish). A male specimen was taken by Parish at Yurimaguas, Peru, April 17, 1920, and is herewith described as the allotype.

Allotype.—Male, length about 2.5 mm.; wing 2.5 mm.

Similar to the type female. Male hypopygium (Plate IV, fig. 8) with the pleurites comparatively large and stout; two pleural appendages, the outer one deeply bifid, the outer branch a slender chitinized spine, the inner branch shorter, stout, the apex a little enlarged and covered with minute spinules; inner pleural appendage a flattened arm whose apex is obtusely rounded and provided with a few tiny setae. Gonapophyses very large and powerful, about as long as the pleurites themselves, each apophyse appearing as a blackened blade directed caudad, the acute tips curved proximad and subcontiguous with one another at the midline of the body; before the tip on the proximal face, each apophyse is dilated into a thin, flaring blade whose margin is weakly serrate.

Erioptera (Erioptera) cladophora Alexander.

1920. *Erioptera (Mesocyphona) cladophora* Alexander, Can. Ent., vol. 52, p. 142.

The types are from Manáos, Brazil, October 31 to November 4, 1919 (H. S. Parish); Itacoatiara, Brazil, October 22, 1919 (H. S. Parish). Additional specimens were taken at Iquitos, Peru, March 10 to May 12, 1920 (H. S. Parish); Yurimaguas, Peru, April 17, 1920 (H. S. Parish).

Erioptera (Erioptera) annulipes Williston.

1896. *Erioptera annulipes* Williston, Trans. Ent. Soc. Lond., 1896, p. 294.

Igarapé Assú, Brazil, January 19, 1912 (H. S. Parish).

Yurimaguas, Peru, April 7, 1920 (H. S. Parish).

Amazonian material was sent to Mr. Edwards, of the British Museum, for comparison with Williston's types (females). Mr. Edwards reports the following differences: basal section of R_2 shorter than crossvein, less than half as long as R_{2+3} ; white pleural

stripe less conspicuous; white rings on legs rather narrower, the seven black and white rings on hind tibiae all equal in length. Mr. Edwards thinks that the two forms are probably specifically the same, an opinion in which the writer concurs.

Erioptera (Erioptera) apicalba sp. n.

Sex?—Wing 2.8 mm.

The type is badly eaten by ants. The species is related to *E. annulipes* Williston, differing as follows: General coloration much darker. Mesonotal praescutum dark gray with a broad brownish median stripe that is narrowly divided by a pale line, the tuberculate pits lying one on either margin of this pale line; a small obscure yellow area before the pseudosutural foveae; margin of the praescutum narrowly whitish. Pleura dark brown; a narrow, but conspicuous, ventral silvery white longitudinal stripe extending from behind the fore coxae to the base of the abdomen; above the hind coxae a much abbreviated similar stripe lying parallel with the first; sternum heavily gray pruinose; dorso-pleural membranes sulphur yellow. Legs with the trochanters brown; tibiae with three black bands, on the middle legs these being much broader than the pale interspaces, on the posterior legs as wide as or narrower than the interspaces. Wings with a uniform gray tinge; an indistinct whitish suffusion across the disk in the region of the cord; the costal margin, including cells *C* and *Sc*, white, interrupted by three small dark brown spots, one each at the tips of *Sc*₁, *R*₁ and *R*₂, these dark areas being smaller than the interspaces; the entire wing-apex is broadly white excepting a narrow seam along vein *R*₄+₅ which continues almost to the margin; rounded white spots in the ends of cells 2nd *R*₁, *M*₃, *Cu*₁ and *Cu*; veins dark brown, paler in the hyaline areas, the veins that traverse the wing-apex being snowy-white, including their macrotrichiae; narrow brown seams at *Sc*₂ and along the cord. Venation: cell 1st *M*₂ open by the atrophy of *m* as in this group of species; vein 2nd *A* gently arcuated near its tip.

Habitat.—Brazil.

Holotype, Sex?, Teffé, December 29, 1919 (H. S. Parish).

Erioptera (Mesocyphona) parva brasiliensis Alexander.

1913. *Erioptera parva brasiliensis* Alexander, Proc. U. S. Nat. Mus., vol. 44, p. 514.

The types were from Igarapé Assú, Brazil, January 19–February 7, 1912 (H. S. Parish). Other material is available as follows:

Pratá, June 30, 1919 (H. S. Parish).

Manãos, Brazil, November 1, 1919 (H. S. Parish).

Teffé, Brazil, January 16, 1920 (H. S. Parish).

Iquitos, Peru, March 20, 1920 (H. S. Parish).

Yurimaguas, Peru, March 25–April 15, 1920 (H. S. Parish).

Napo River, Peru, June 15, 1920 (H. S. Parish).

Erioptera (Mesocyphona) bicinctipes Alexander.

1913. *Erioptera bicinctipes* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 519, 520.

The types were from Igarapé Assú, Brazil, January 25 to February 7, 1912 (H. S. Parish). The following additional records are now available:

Pratá, June 30, 1919 (H. S. Parish).

Itacoatiára, Brazil, October 24, 1919 (H. S. Parish).

Flores, Brazil, November 19, 1919 (H. S. Parish).

Teffé, Brazil, December 22, 1919 (H. S. Parish).

Iquitos, Peru, March, 1920 (H. S. Parish).

Yurimaguas, Peru, April 7, 1920 (H. S. Parish).

Napo River, Peru, June 6, 1920 (H. S. Parish).

Erioptera (Mesocyphona) diffusa sp. n.

Related to *E. eiseni* Alexander; coloration of the mesonotum yellowish, without markings; wings pale brown with large, ill-defined whitish subhyaline spots; tip of vein M_3 lying free in the membrane.

Female.—Length 3.2 mm.; wing 2.9 mm.

Head badly eaten by ants. Mesonotum yellow without darker markings. Pleura light yellow with two narrow, rather ill-defined brownish longitudinal stripes. Halteres broken. Legs with the coxae and trochanters light yellow; femora pale brownish yellow, the tips conspicuously golden yellow; a broad but ill-defined brown subapical ring; sometimes there is a second dark ring near mid-length of the segment; remainder of the legs yellow. Wings broad, the costal region brown, the remainder of the membrane rather pale yellowish brown, with about sixteen whitish subhyaline spots arranged as follows: at arculus, at origin of R_s , at Sc_2 , along the cord and about ten at the apices of the cells between the ends of the longitudinal veins; veins pale yellow. Venation: tip of vein M_3 lying free in the membrane, its basal connection with M_{1+2} lost by atrophy; tip of vein 2nd A curved strongly toward the wing-tip. Abdomen brownish yellow, the sternites paler. Ovipositor with the valves long and slender, the tergal valves acute at their tips.

Habitat.—Brazil.

Holotype, ♀, Teffé, December 23, 1919 (H. S. Parish).

Erioptera (Mesocyphona) invariegata sp. n.

General coloration uniformly dark brown, this color including the legs; wings uniformly brownish gray.

Female.—Length about 2.5 mm.; wing 2.9 mm.

Rostrum and palpi dark brown. Antennae dark brown, the flagellar segments cylindrical. Head dark brown. Thorax dark

brown, the pleura faintly dusted with gray. Halteres pale brown, the knobs darker brown. Legs with the coxae and trochanters dark brown; remainder of the legs uniformly brown. Wings uniformly brownish gray; veins pale brown. Venation: *Sc* long, *Sc*₁ ending about opposite one-third the length of *R*₂₊₃; *r* on *R*₂ a little more than its own length beyond the fork of *R*₂₊₃; cell 1st *M*₂ open by the atrophy of the outer deflection of *M*₃; basal deflection of *Cu*₁ immediately before the fork of *M*; 2nd *Anal* vein weakly bisinuous. Abdomen dark brown; valves of the ovipositor long and slender, acute; in the type, the tips of the tergal valves are decurved.

Habitat.—Peru.

Holotype, ♀, Yurimaguas, March 23, 1920 (H. S. Parish).

Erioptera invariegata differs from the other species of *Mesocyphona* with unmarked wings in the uniformly dark brown legs.

Genus **MOLOPHILUS** Curtis

1833. *Molophilus* Curtis, Brit. Ent., p. 444.

EUMOLOPHILUS subgen. n.

Generally similar to *Molophilus*, differing as follows: The tibiae and metatarsi of the hind legs in both sexes are adorned with conspicuous erect fringes of long, dark hairs that give to the legs a fan-like appearance. Male hypopygium with a conspicuous lyriiform plate.

Type of the subgenus.—*Molophilus* (*Eumolophilus*) *thaumastopodus* Alexander (Brazil).

This subgeneric group is proposed for two species of Amazonian crane-flies that present a remarkable appearance, due to the conspicuous trichiation of the legs, especially the posterior tibiae and metatarsi. The general appearance of the flies is not unlike that of certain species of the Culicid genus *Sabethes* inhabiting this same region. Although the general appearance of the two species referred to this subgenus is very unlike typical *Molophilus*, the structural details show the two groups to be closely allied. Besides the type of the subgenus, the new species *M. (E.) pennipes* belongs to this group.

***Molophilus* (*Eumolophilus*) *pennipes* sp. n.**

Male.—Length about 5 mm.; wing 4.5 mm.; hind leg, femur, 4.9 mm.; tibia 3.9 mm.

Female.—Length about 5 mm.; wing 4.8 mm.; hind leg, femur, 5.1 mm.; tibia 4.1 mm.

Generally similar to *M. (E.) thaumastopodus* Alexander, differing as follows: size much larger as shown by the measurements. An-

tennae of the male elongate, bicolorous, the base and apex of each flagellar segment pale, the middle portion of each segment provided with long, conspicuous, outspreading hairs, very much as in males of the genus *Polymera*. The oar-like brushes on the posterior legs with conspicuous violaceous reflexions. Male hypopygium with the lyriform plate small, the two arms powerful, divergent, the tips incurved; a little more than the apical third of each arm is provided on the inner face with conspicuous erect spines, those toward the tip more appressed; among these spines, at about two-thirds the length of the arm is an extensive cushion of short, erect, bristle-like spines. In *M. thaumastopodus*, the arms of the lyriform plate are slender, directed caudad and laterad, with only the tips directed a little proximad; these arms are entirely smooth with the exception of four or five appressed spines at the very tip on the inner face; there is no evidence of a cushion of shorter bristles.

Habitat.—Brazil, Peru.

Holotype, ♂, Santa Felipe, Brazil, June 26, 1920 (H. S. Parish).

Allotype, ♀, Iquitos, Peru, May 25, 1920 (H. S. Parish).

Molophilus (**Eumolophilus**) **thaumastopodus** Alexander.

1913. *Molophilus thaumastopodus* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 510, 511.

The types were from Pará and Igarapé Assú, Brazil. Other material is from Flores, Brazil, November 10, 1919; Manáos, Brazil, November 1, 1919 (H. S. Parish); and Teffé, Brazil (H. S. Parish).

Genus **CRYPTOLABIS** Osten Sacken.

1859. *Cryptolabis* Osten Sacken, Proc. Acad. Nat. Sci. Phila., p. 224.

Cryptolabis (**Cryptolabis**) **tenuicincta** sp. n.

General coloration whitish testaceous; thoracic pleura with a conspicuous brown longitudinal stripe; wings subhyaline with a brown spot at the arculus and a narrow brown crossband at the cord; cell M_3 very deep, extending basad almost to the fork of M , an apparent $m-cu$ crossvein being formed.

Sex?—Wing 4.2 mm.

Head lacking in the unique type. Mesonotum pale whitish testaceous, unmarked with darker. Pleura concolorous with the dorsum, the dorsal sclerites with a broad, dark brown, longitudinal stripe extending from the cervical sclerites to beneath the root of the halteres. Halteres pale, the knobs broken. Legs with the coxae and trochanters whitish testaceous; femora and tibiae pale; tarsi broken; femora and tibiae with conspicuous, erect, pale hairs. Wings subhyaline; a brownish spot at the arculus; a narrow and indistinct brownish seam along the cord, beginning as a faint double marking on R_s and R_{2+3} , continued caudad across the wing to the posterior margin; veins pale, darker in the infuscated areas. Sparse macrotrichiae in the distal ends of cells 2nd R_1 , R_2 , R_3 , R_5 , M_2 , M_3 .

and Cu_1 . Venation: Rs short, straight or feebly convex as in the genus, cell 1st R_1 consequently subtriangular as in *C. paradoxa* and allies; R_{2+3} a little more than one-half Rs ; basal deflection of R_2 perpendicular to R_{2+3} , in alignment with r ; basal deflection of R_{4+5} punctiform, almost in alignment with Rs ; $r-m$ long, about two-thirds of Rs ; cell M_3 very deep, vein M_3 originating basad of the deflection of Cu_1 , in all other species of the genus, vein M_3 arises distad of the deflection of Cu_1 and cell M_3 is consequently petiolate; in the present species, cell M_3 is entirely sessile; there thus appears to be a long $m-cu$ crossvein preserved that is about half as long as the deflection of Cu_1 . Abdomen lacking.

Habitat.—Peru.

Holotype, Sex?, Yurimaguas, April 10, 1920 (H. S. Parish).

Although the type specimen of this interesting new species of *Cryptolabis* is badly eaten by Psocids, it is described in order to present a new venational peculiarity in the tribe, the *apparent* retention of the $m-cu$ crossvein. The discovery of this fly lends support to Tillyard's theory of a four-branched media in the generalized Diptera. By adopting this theory in the present instance, the *apparent* $m-cu$ crossvein becomes the basal section of M_4 and this would seem to be a far more logical interpretation than to consider the element as being $m-cu$, since this is lacking in almost every known Limnobiine crane-fly.

Genus **GNOPHOMYIA** Osten Sacken.

1859. *Gnophomyia* Osten Sacken, Proc. Acad. Nat. Sci. Phila., p. 223.

Species of *Gnophomyia* are rather numerous in the Amazonian Region. Additional species will very probably be discovered, especially in Peruvian territory.

Gnophomyia rubicundula sp. n.

General coloration black, the mesonotum and dorsal thoracic pleurites reddish orange; wings with a brownish tinge; no macrotrichiae in the cells of the wing; Sc long, ending opposite r ; Rs relatively short and straight; veins R_2 and R_3 long and parallel; basal deflection of R_{4+5} very short, in alignment with Rs .

Male.—Length about 7.8 mm.; wing 7.8 mm.

Rostrum and palpi black. Antennae black, moderately elongated; flagellar segments cylindrical. Head black. Pronotum black, the lateral margins of the scutellum yellowish. Mesonotum reddish orange, unmarked. Propleura and ventral portions of the mesopleura and metapleura blackish; dorsal pleurites reddish orange. Sternites black. Halteres black, the base of the stem obscure orange. Legs with the coxae and trochanters black; remainder of the legs black, the extreme bases of the fore femora a little brightened. Wings with a brownish tinge; costal and subcostal cells and

the anal angle a little darker; stigma very narrow and indistinctly brownish; veins brownish black. Venation: Sc long, Sc_1 extending to just beyond r , Sc_2 some distance from the tip of Sc_1 , the latter alone being longer than the basal deflection of Cu_1 ; Rs relatively short and almost straight; R_{2+3} about one-third longer than the basal deflection of Cu_1 and more than one-half of Rs ; r on R_2 a little more than its own length beyond the fork of R_{2+3} ; veins R_2 and R_3 long, running parallel to one another; basal deflection of R_{4+5} very short, almost in alignment with Rs and the distal section of R_{4+5} ; cell $1st\ M_2$ long and narrow, widened distally, m and the outer deflection of M_3 subequal; basal deflection of Cu_1 at about one-third the length of cell $1st\ M_2$; vein $2nd\ A$ straight. Abdomen black.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 1, 1920 (H. S. Parish).

Gnophomyia axillaris sp. n.

General coloration black; wings subhyaline, the costal and subcostal cells, the stigma and the wing-axil brown.

Male.—Length about 6 mm.; wing 6.3 mm.

Rostrum and palpi black. Antennae black. Head black. Thorax deep black, including the legs and halteres. Wings subhyaline; costal and subcostal cells, the stigma and the wing-axil brown; faint brown seams along Cu and at the wing-apex; veins dark brown. Venation: Sc long, Sc_1 extending to beyond two-thirds the length of Rs ; Sc_2 some distance from the tip of Sc_1 , the latter alone being nearly equal to R_{2+3} ; Rs straight, in alignment with R_{4+5} , the deflection of the latter obliterated; R_{2+3} straight; r faint, on R_2 at about its own length beyond the fork of R_{2+3} ; cell $1st\ M_2$ long and narrow, widened distally; basal deflection of Cu_1 at just before one-third its length. Abdomen black. Male hypopygium with the longest pleural appendage acicular, tapering to the subacute tip.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 24, 1920 (H. S. Parish).

Gnophomyia nigrina (Wiedemann)

Igarapé Assú, Brazil, July 16, 1919 (H. S. Parish).

Pratá, Brazil, July 1-4, 1919 (H. S. Parish).

Teffé, Brazil, December 25, 1919 (H. S. Parish).

Yurimaguas, Peru, March 21-April 20, 1920 (H. S. Parish).

Gnophomyia subhyalina Alexander.

1913. *Gnophomyia subhyalina* Alexander, Proc. U. S. Nat. Mus., vol. 44, p. 523.

Igarapé Assú, Brazil, 1912 (H. S. Parish).

Pratá, Brazil, July 4, 1919 (H. S. Parish).

Flores, Brazil, November 14, 1919 (H. S. Parish).

Teffé, Brazil, December 22, 1919 (H. S. Parish).

Gnophomyia bisecta Alexander.

1920. *Gnophomyia bisecta* Alexander, Ent. News, vol. 31, pp. 72, 73.

The type was from Parintins, Brazil, October 3, 1919 (H. S. Parish). Other specimens were taken at Manáos, Brazil, October 31, 1919, and at Teffé, Brazil, December 16–23, 1920 (H. S. Parish).

Gnophomyia osten-sackeni Skuse.

1887. *Gnophomyia fascipennis* Osten Sacken, Berl. Ent. Zeitsch., Bd. 31, pt. 2, pp. 199, 200 (preoccupied).

1889. *Gnophomyia osten-sackeni* Skuse, Proc. Linn. Soc. New South Wales, ser. 2, vol. 4, p. 825.

The type was collected along the Amazon River by Bates.

Gnophomyia leucoplaca sp. n.

General coloration black; mesonotal scutum, scutellum and pronotum and the dorsal sclerites of the pleura orange; wings dark brown with a broad whitish crossband near midlength; cells of the wing beyond the cord with abundant macrotrichiae.

Female.—Length 7.7 mm.; wing 7 mm.

Rostrum and palpi black. Antennae black, rather long for this sex, the segments oval. Head black. Pronotum black. Mesonotal praescutum black, the lateral margins obscure orange; remainder of the mesonotum orange. Pleura with the ventral sclerites black, the dorsal region abruptly orange; a brownish spot beneath the wing-root. Halteres brownish black, the extreme base of the stem indistinctly paler. Legs black. Wings dark brown with a broad whitish crossband near midlength; costal and subcostal cells uniformly dark; base of the wing darkened to slightly beyond the level of the origin of *Rs*, paler brown in the anal cells, this color continued indistinctly along vein *Cu* to the wing-margin; wing-apex dark brown, this including all of cells *2nd R*₁, *R*₂, *R*₃, *R*₅, *2nd M*₂, the outer end of *1st R*₁; the cephalic half of *1st M*₂; all but the base of *M*₃ and the outer cephalic end of *Cu*₁; the white crossband includes all but the base and tip of cell *1st R*₁; ends of cells *R*, *M* and *Cu*; bases of cells *1st M*₂, *M*₃ and *Cu*₁. Conspicuous macrotrichiae in cells *2nd R*₁, *R*₂, *R*₃, *R*₅, *1st M*₂, *2nd M*₂, *M*₃ and *Cu*₁, thus occupying practically all the wing-disk beyond the cord. Venation: *Sc* moderately long, *Sc*₁ extending to just before the end of *Rs*, *Sc*₂ rather close to the tip of *Sc*₁, the latter being a little shorter than *m*; *Rs* long, gently arcuated; *R*₂₊₃ shorter than the basal deflection of *Cu*₁; *r* on *R*₂₊₃ immediately before the fork; basal deflection of *R*₄₊₅ weakly angulated; cell *1st M*₂ small, subquadrate; *m* and outer deflection of *M*₃ subequal; basal deflection of *Cu*₁ shortly beyond the fork of *M*; vein *2nd A* sinuous. Abdomen black. Ovipositor with the tergal valves slender, strongly upcurved.

Habitat.—Brazil.

Holotype, ♀, Teffé, January 12, 1920 (H. S. Parish).

Genus **GONOMYIA** Meigen.

1818. *Gonomyia* Meigen, Syst. Besch., Bd. 1, p. 146.

The genus *Gonomyia* is one of the characteristic Tipulid genera throughout the tropics of the New World. Species of the subgenus *Leiponeura* Skuse are especially abundant in the Amazonian Region.

Gonomyia (Progonomyia) parænsis Alexander.

1920. *Gonomyia (Gonomyella) parænsis* Alexander, Journ. N. Y. Ent. Soc., vol. 28, pp. 7, 8.

The types were taken at Pratá, Brazil, June 30, 1919 (H. S. Parish).

The name *Progonomyia* is a re-naming of *Gonomyella* Alexander.

Gonomyia (Leiponeura) pleuralis (Williston)

1896. *Atarba pleuralis* Williston, Trans. Ent. Soc. Lond., 1896, p. 289.

Manáos, Brazil, October 31–November 4, 1919 (H. S. Parish).

Flores, Brazil, November 10, 1919 (H. S. Parish).

Gonomyia (Leiponeura) amazona Alexander.

1912. *Gonomyia (Leiponeura) amazona* Alexander, Ent. News, vol. 23, pp. 418–420.

Napo River, Peru, June 15, 1920 (H. S. Parish).

The male hypopygium was described and figured by the writer at the time of the original characterization of the species. The details of the pleurites and appendages are not clearly indicated there and may be further discussed as follows:

Outer lateral angle of the pleurite produced into a large, fleshy cylindrical lobe; two pleural appendages, the ventral appendage small, chitinized, appearing as a small blackened cylinder with the tip narrowly split, at the base with an acute blackened spine; dorsal pleural appendage fleshy, much larger than the chitinized appendage, before the tip with a small acute spine, at the tip with two powerful bristles; proximal face with about a dozen additional bristles.

Gonomyia (Leiponeura) acuminata sp. n. Plate IV, fig. 1.

Belongs to the *cinerea* group; antennal flagellum orange-yellow on the basal half; head yellow with a brown vertical mark; thoracic pleura with a conspicuous longitudinal yellow stripe; wings with *Sc* short; male hypopygium with four pleural appendages, the longest acuminate, bearing a long, acute spine a short distance beyond the base.

Male.—Length about 3.8 mm.; wing 3.7 mm.

Female.—Length about 4.6 mm.; wing 4.5 mm.

Rostrum and palpi dark brown. Antennae with the scape dark brown; flagellar segments orange-yellow, on the outer half of the organ passing into brown; flagellar segments provided with very long verticils in the male. Head light yellow, the vertex with a large median dark brown mark. Pronotum yellow, dark brown medially, the scutellum light sulphur yellow. Mesonotum dark brown, the scutellum narrowly margined posteriorly with obscure yellow. Pleura deep purplish brown, sparsely pruinose; dorsal sclerites obscure brownish yellow; a very conspicuous, moderately broad yellow longitudinal stripe extending from the posterior face of the fore coxae, passing above the mid and hind coxae to the base of the abdomen. Halteres yellow, the base darker; knobs broken. Legs with the fore coxae purplish brown with a yellow spot on the posterior face; mid-coxae purplish brown; posterior coxae obscure yellow, only slightly darkened basally; trochanters obscure yellow; femora pale yellow with a narrow brown subterminal ring; the fore legs are broken but the femora are probably dark brown as in this group of species; tibiae and metatarsi yellow, the tips narrowly infuscated; remainder of the tarsi dark brown. Wings with a strong grayish tinge; cells *C*, *Sc* and most of *R*₁ china-white; stigma oval, brownish gray; veins pale brown, the costa china-white. Venation: *Sc*₁ ending far before the origin of *Rs*, this distance being greater than the length of *Rs*; *Rs* short, strongly arcuated at origin; cell 1st *M*₂ open by the atrophy of the outer deflection of *M*₃; basal deflection of *Cu*₁ at the fork of *M*. Abdomen dark brown, the tergites narrowly margined posteriorly with obscure yellow, broader on the posterior segments; sternites more uniformly brown. Male hypopygium (Plate IV, Fig. 1) with the pleurites rather short and stout, shorter than the longest pleural appendage; pleural appendages four in number; the longest or ventral appendage is a slender, slightly curved, chitinized arm that tapers gradually to the rather blunt apex, near the base on the inner face with a prominent, acute spine that is about two-fifths as long as the apical point; the second appendage is an apical, elongate needle-like rod directed proximad, tapering to the acute blackened point; third appendage elongate-triangular, the apex a slightly curved black spine; the fourth or dorsal appendage is a pale fleshy lobe, roughly triangular in form, the apex produced into a cylindrical arm, this arm and the proximal face of the appendage set with about seventeen mostly powerful bristles. The penis-guard is a small, feebly chitinized structure that is subtended by the much longer gonapophyses, these appearing as two delicate setigerous cushions.

Habitat.—Peru, Argentina.

Holotype, ♂, Iquitos, Peru, May 18, 1920 (H. S. Parish).

Allotopotype, ♀, May 11, 1920.

Paratype, ♂, Famaillá, Tucuman, Argentina, October 12, 1920 (V. Weiser).

Gonomyia (Leiponeura) falcifer sp. n. Plate IV, fig. 2.

Belongs to the *cinerea* group; male hypopygium with three pleural appendages, the ventral appendage elongate, falcate, on its proximal face near the base with two erect spines; dorsal appendage a small, pale, setigerous lobe; penis-guard and gonapophyses without conspicuous chitinated parts.

Male.—Length about 3.5 mm.; wing 3.8 mm.

Generally similar to *G. (L.) acuminata* sp. n., differing as follows: Posterior lateral margins of the mesonotal scutum more distinctly yellowish. Fore legs present in the type; femora dark brown with only the bases narrowly paler. Wings with *Rs* a little straighter. Male hypopygium (Plate IV, Fig. 2) conspicuously different from any described species. The pleurites are a little longer than in *acuminata*; pleural appendages only three in number; the longest or ventral of these is broad basally and here produced on the proximal face into two short, subacute spines that are directed caudad, one of these blackened and with the margin weakly serrulate, the other spine a little longer, pale, only the acute tip a little darkened; the outer or lateral face of this appendage runs caudad into a long, moderately slender curved point that is approximately as long as the pleurite itself, the tip obtusely and indistinctly recurved, the inner margin weakly serrulate; the intermediate pleural appendage is a small, flattened blade, pale at the base, the tip produced into two conspicuous blackened spines; the third or dorsal appendage is a small, roughly subglobular lobe, pale, provided with about ten conspicuous setae. Penis-guard and gonapophyses pale with few evident chitinated parts; the gonapophyses appear as two pale cushions that are microscopically setigerous.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 13, 1920 (H. S. Parish).

Gonomyia (Leiponeura) machaeria sp. n.

Closely related to *G. helophila* Alexander; male hypopygium with the ventral pleural appendage sword-like, the basal half dilated; dorsal appendage entirely fleshy with a small, oval, glabrous lobe at its base; no intermediate appendage.

Male.—Length about 3.2 mm.; wing 3 mm.

Rostrum and palpi dark brown. Antennal scape orange; flagellum broken. Head brown, paler behind. Pronotum light yellow. Mesonotal praescutum gray with four narrow, brown, longitudinal stripes, the intermediate pair longer and almost confluent; scutal lobes brown; scutellum and postnotum light gray pruinose. Pleura dark brown, with a broad white longitudinal stripe, beginning immediately behind the fore coxae, passing ventrad of the halteres to the base of the abdomen; dorsad of this conspicuous white stripe is a very narrow and less distinct silvery-gray stripe that branches

out ventrad of the wing-root, passing dorsad of the halteres; the dark brown line that separates these two pale stripes is about as wide as the narrow dorsal stripe. Halteres light brown, the knobs broken. Legs with the coxae and trochanters yellow; fore femora dark brown; other femora brownish yellow, with a narrow apical or subapical darker brown ring; tibiae and tarsi dark brown. Wings with a faint grayish tinge; stigma indistinctly brownish; veins pale brown, the costal margin whitish; veins comprising the cord darker brown. Venation: *Sc* short, *Sc*₁ ending a short distance before the origin of *Rs*, the distance being about equal to *r-m* or a little less; *Sc*₂ a short distance from the tip of *Sc*₁; *Rs* short, subangulate at origin; cell 1st *M*₂ open by the atrophy of the outer deflection of *M*₂; basal deflection of *Cu*₁ immediately before the fork of *M*. Abdominal tergites dark brown, the sternites more obscure brown. Male hypopygium with the ventral appendage somewhat sword-like in appearance, heavily chitinized, before midlength dilated into a flattened wing; apex of this appendage subcylindrical, the tip suddenly narrowed; dorsal pleural appendage entirely fleshy as in *G. helophila*, at the base with a small, oval, glabrous lobe; the enlarged apex of the appendage with numerous setae; no intermediate pleural appendage as in *G. helophila*.

Habitat.—Peru.

Holotype, ♂, Iquitos, March 5, 1920 (H. S. Parish).

Gonomyia (Leiponeura) phoroctenia sp. n. Plate IV, fig. 7.

Rostrum reddish orange; antennae dark brownish black; mesonotum brown, the scutum with the anterior median area yellow; scutellum broadly margined caudally with yellowish; pleura dark, blue-gray pruinose, the dorso-pleural membrane and a broad, longitudinal stripe yellowish; halteres with the knobs yellow; wings strongly tinged with brown; male hypopygium with a single pleural appendage; penis-guard and gonapophyses complex and asymmetrical; region of the ninth tergite with two combs of small spines.

Male.—Length about 4 mm.; wing 3.8 mm.

Rostrum reddish orange; palpi dark brown. Antennae dark brownish black, the second scapal segment enlarged, suboval; flagellum with very long verticils in the male. Head dark, the vertex behind yellowish pollinose. Pronotal scutellum light sulphur yellow. Mesonotal praescutum brown, the lateral margins caudad of the level of the pseudosutural foveae more bluish; scutum dark with a brownish bloom, the anterior median area dull yellow; scutellum broadly dull yellow behind; postnotum light gray pruinose. Pleura with the dorso-pleural membranes dull yellow; remainder of the pleura dark, blue-gray pruinose, with a broad but ill-defined yellowish white longitudinal stripe that extends from behind the fore coxae past the root of the halteres to the abdomen. Halteres pale, the knobs yellow. Legs with the coxae blue-gray; trochanters dusky; remainder of the legs dark brown. Wings relatively broad, with a

strong brownish tinge; cord and outer end of cell 1st M_2 seamed with slightly darker brown; stigmal region barely darkened; veins brown. Venation: Sc relatively long, Sc_1 ending immediately before the origin of Rs , Sc_2 a short distance from the tip of Sc_1 , Sc_1 alone being a little longer than the outer deflection of M_3 ; Rs slightly sinuous; R_{2+3} nearly straight; cell R_1 nearly parallel-sided. Abdominal tergites brown, the sternites a little paler. Male hypopygium (Plate IV, Fig. 7) with the pleurites long and slender, clothed with erect bristles of which two or three on the outer distal end are very long; a single pleural appendage, this roughly subcircular in outline, entirely pale, the inner face produced proximad into a large, pale, compressed bristle or fascicle of bristles; surrounding this powerful bristle are about five smaller setae. The penis-guard and gonapophyses form a powerful cylindrical mass that occupies about all of the genital chamber; the penis-guard is long and slender, sinuous, as in the *manca* group of the subgenus. Of the gonapophyses the two longest are unequal in size, both blackened apically, elongate, flattened, with one margin serrulate; at the base of these appendages is a small, powerful black tooth with numerous plush-like hairs at its base. What appears to be projections of the ninth tergite are cylindrical arms tipped with a palmate cluster of about eight powerful spines, the more lateral of these shorter, gradually lengthening proximad, the innermost being replaced by abundant long bristles.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 18, 1920 (H. S. Parish).

Gonomyia phoroctenia, together with two other species described at this time, *G. ctenophora* and *G. crepuscula*, form a group of three very closely related species with the general body coloration very similar but the details of structure of the male hypopygium strikingly different. To these there should probably be added *G. bispinosa* sp. n., although in this form there are two pleural appendages and the comb on the ninth tergite is reduced to a pad of delicate appressed setae.

***Gonomyia (Leiponeura) ctenophora* sp. n.** Plate IV, fig. 6.

Male.—Length about 3.8 mm.; wing 3.5 mm.

Generally similar to *G. (L.) phoroctenia* sp. n., differing as follows: Size slightly smaller. Scutellum even more brownish yellow behind. Dorso-pleural membranes and pleural stripe brighter yellow. Wings a little narrower and paler. Male hypopygium (Plate IV, Fig. 6) with the pleurites long and slender, clothed with long bristles that become longer toward the apex of the sclerite on the outer face; a single pleural appendage, this roughly cylindrical in form with a conspicuous blackened spine on the outer margin near midlength; the narrowed cylindrical tip produced into a bristle or fascicle of bristles; a few additional setae are grouped on this narrowed apex. The penis-guard and gonapophyses are not as large or complicated

in structure as in *phoroctenia*, there being two elongate, blade-like structures that are blackened at their tips. The penis-guard itself is flattened, the margin produced into an acicular spine; at the base of the penis-guard is a small bottle-shaped appendage with the neck heavily blackened. On the ninth tergite are two cylindrical arms as in *phoroctenia*, these bearing a comb of six powerful curved teeth, shortest proximally, gradually lengthening toward the outside; the outer lateral angles are replaced by long yellowish hairs. In the slide mounts of *phoroctenia* these arms are directed cephalad and the teeth are on the lateral side but this condition may be due to torsion in mounting. The figures show the hypopygia as they appear on the slides.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 17, 1920 (H. S. Parish).

Paratopotype, ♂, May 15, 1920.

Gonomyia (Leiponeura) crepuscula sp. n. Plate IV, figs. 5, 5A.

Male.—Length about 3.7 mm.; wing 3.8 mm.

Generally similar to *G. (L.) phoroctenia*, sp. n., differing as follows: Sc_1 ending a short distance before the origin of R_s ; basal deflection of Cu_1 a short distance before the fork of M . Male hypopygium (Plate IV, Figs. 5, 5A) with the pleurites long and slender, clothed with bristles as in *phoroctenia*. A single pleural appendage, this appearing as a short curved chitinized horn, the tips acute. Gonapophyses and penis-guard forming a complicated mass as in *phoroctenia*, there being two elongate organs, one slightly bent at the apex and heavily blackened, the second, which is presumably the penis-guard, pale, narrowed to the acute tip. Besides these there is a blackened flattened plate surrounding the penis-guard. The general arrangement of teeth on the ninth tergite is here approximately as in *phoroctenia* and *ctenophora* but the number of teeth is greatly reduced, there being but three or four of these, the outermost being very much more powerful than any of the others, the inner angle clothed with delicate appressed hairs.

Habitat.—Peru.

Holotype, ♂, Napo River, June 15, 1920 (H. S. Parish).

Gonomyia (Leiponeura) bispinosa sp. n. Plate IV, figs. 4, 4A.

Rostrum obscure reddish orange; antennae dark brown; pleura pale yellow, heavily pruinose with snowy white, the longitudinal stripe being very broad and ill-defined; knobs of the halteres yellow; male hypopygium with the pleural appendages two in number, similar to one another in shape, cylindrical, curved, each tipped with a powerful curved spine; penis-guard relatively long and slender.

Male.—Length about 3 mm.; wing 3.3 mm.

Rostrum obscure reddish orange. Antennae with the second scapal segment enlarged, subglobular, dark brown, the lower sur-

face more reddish; flagellum dark brown. The thoracic pleura is largely pale yellow, snowy-white pollinose, this appearing as an ill-defined, very broad, longitudinal stripe. Halteres brown, the base pale, the knobs yellow. Legs with the coxae brown; trochanters more testaceous; remainder of the legs brown. Wings grayish subhyaline; veins pale brown. Venation: Sc rather short, ending some distance before the origin of R_s ; R_{2+3} nearly straight, at the outer end curved suddenly cephalad; basal deflection of Cu_1 just before the fork of M . Abdomen dark brown, the sternites paler. Male hypopygium (Plate IV, Fig. 4, 4A) with the pleurites relatively short and stout; two pleural appendages borne at the extreme apices of the pleurites; these appendages are very similar to one another in general shape but the outer one is slightly larger than the inner one. They appear as pale, cylindrical, gently curved appendages, the tips suddenly narrowed into powerful blackened spines; before the blackened tips with three or four small setae. The penis-guard is relatively long and slender, tapering gradually to the apex. The two patches of spines borne by *G. phorocenia* and allies are here represented by two pads of delicate appressed setae, no spines being evident.

Habitat.—Peru.

Holotype, ♂, Iquitos, May 25, 1920 (H. S. Parish).

Gonomyia (Leiponeura) spicata sp. n. Plate IV, fig. 3.

Rostrum brownish black; antennal scape yellowish, flagellum black; thoracic pleura brown with a broad, conspicuous, yellowish white longitudinal stripe; knobs of the halteres yellow, male hypopygium with two pleural appendages, the ventral appendage being a powerful, chitinized spike with the tip prolonged into an acute point; the dorsal appendage is very small and fleshy; gonapophyses and penis-guard arranged in pairs.

Male.—Length about 3 mm.; wing 3.2–3.3 mm.

Rostrum and palpi brownish black. Antennae with the scapasegments yellow, the flagellum black, the segments with conspicuous verticils. Head yellow, the vertex marked with dark brown. Mesonotum brown, narrowly yellowish laterally; median area of the scutum broadly yellow; scutellum broadly obscure yellow behind; postnotum obscure yellow anteriorly, passing into brown on the caudal half. Pleura brown, the dorso-pleural membranes and the posterior sclerites light yellow; a broad, conspicuous yellowish white longitudinal stripe extending from the fore coxae to the base of the abdomen, passing immediately beneath the base of the halteres. Halteres light brown, the knobs yellow. Legs with the fore coxae yellowish on the outer face; middle and hind coxae with the outer faces infuscated basally, sparsely pruinose; trochanters light brown; remainder of the legs brown. Wings with a strong brownish tinge, the costal and subcostal cells paler; veins pale brown. Venation: Sc_1 ending opposite the origin of R_s , Sc_2 rather close to the tip,

Sc_1 alone being about equal to m ; Rs slightly angulated at origin; basal deflection of Cu_1 immediately beyond the fork of M . Abdominal tergites light brown, more yellowish laterally; sternites paler. Male hypopygium (Plate IV, fig. 3) with the pleurites moderately stout, the outer lateral angle extended into a pale fleshy lobe; two pleural appendages, the ventral appendage a powerful chitinized spike, the base cylindrical, soon bent strongly proximad, slightly enlarged, gradually narrowed to the acute, needle-like point; in the paratype figured, there is a small, acute spine on the cephalic side opposite the bend; dorsal pleural appendage a relatively small, pale, fleshy lobe, the truncated apex provided with about a dozen setae of which one is much more powerful than the others. Gonapophyses and penis-guard arranged in pairs, there being three sets of structures; the ventral pair arise from an enlarged base, slender, the obtuse tips a little dilated and directed slightly ventrad; the middle pair which are presumably the guards of the penis are longer, the obtuse apices a little dilated; the third or dorsal pair consist of two parallel, cylindrical lobes that bear two or three bristles along the outer margin and two others at the apex of each.

Habitat.—Peru.

Holotype, ♂, Napo River, June 15, 1920 (H. S. Parish).

Paratype, ♂, Yurimaguas, April 17, 1920 (H. S. Parish).

¹ Genus **PARATROPEZA** Schiner.

1866. *Paratropeza* Schiner, Verh. Zool.-bot. Ges. Wien, p. 932.

The only species of *Paratropeza* known from the Amazons is *P. collaris* Osten Sacken.

Paratropeza collaris Osten Sacken.

1887. *Paratropeza collaris* Osten Sacken, Berl. Ent. Zeitsch., Bd. 31, pt. 2, p. 190.

The type was collected by Bates along the Upper Amazon River, possibly at Teffé.

Genus **TEUCHOLABIS** Osten Sacken.

1859. *Teucholabis* Osten Sacken, Proc. Acad. Nat. Sci. Phila., p. 222.

Teucholabis is one of the dominant crane-fly genera in the Tropics of the New World.

Teucholabis pulchella Alexander.

1913. *Teucholabis pulchella* Alexander, Psyche, vol. 20, p. 44.

The type is from Igarapé Assú, Brazil, January 30, 1912 (H. S. Parish).

Teucholabis decora Alexander.

1920. *Teucholabis decora* Alexander, Ent. News, vol. 31, pp. 71, 72.

The type is from Igarapé Assú, Brazil, June 25, 1919 (H. S. Parish).

Teucholabis melanocephala (Fabricius)

Flores, Brazil, November 10, 1919 (H. S. Parish).

Teffé, Brazil, January 9, 1920 (H. S. Parish).

Yurimaguas, Peru, April 1-17, 1920 (H. S. Parish).

Napo River, Peru, July 10, 1920 (Native Collector).

Teucholabis mendax Alexander.

1920. *Teucholabis mendax* Alexander, Journ. N. Y. Ent. Soc., vol. 28, pp. 5, 6.

The type was from Prata, Brazil, June 30, 1919 (H. S. Parish).

Additional records are as follows:

Iquitos, Peru, March 16, 1920 (H. S. Parish).

Yurimaguas, Peru, April 9-10, 1920 (H. S. Parish).

Napo River, Peru, June 14, 1920 (H. S. Parish).

Teucholabis lugubris Alexander.

1914. *Teucholabis lugubris* Alexander, Trans. Am. Ent. Soc., vol. 40, p. 234.

This interesting species had hitherto been known only from British Guiana.

Igarapé Assú, Brazil, July 15, 1919 (H. S. Parish).

Teucholabis anthracina sp. n.

General coloration shiny coal-black; wings subhyaline with a broad brown crossband at the cord; wing-apex broadly darkened but the apical cells with pale centers; no distinct basal band.

Male.—Length 4.6 mm.; wing 5.2 mm.

Rostrum slender, nearly as long as the remainder of the head, black; palpi black. Antennae black. Head black. Pronotum and mesonotum shiny coal-black. Pleura black, sparsely gray pruinose. Halteres black. Legs black, the extreme bases of the femora very slightly paler. Wings subhyaline; a broad brown crossband at the cord, wing-tip brown, this coloration continued basad along the veins as broad seams that extend almost to the level of the outer end of cell *1st M*₂, the centers of the cells being pale, the band along the cord begins at the large oval stigma, continuing caudad but becoming narrow and indistinct at the fork of *Cu*; the centers of the cells in the wing-tip that are pale include cells *R*₃, *R*₅, *2nd M*₂ and *M*₃; there is no distinct basal band as in *T. rostrata* Enderlein, merely a faint cloud in the base of cell *Cu*; veins dark brown. Venation: *Sc* long, *Sc*₁ extending to just beyond midlength of *R*₃, *Sc*₁ alone being a little shorter than *r*; *R*₃ long, arcuated; *r* on *R*₂+₄ about half its length beyond the fork of *R*₃; *R*₁ beyond *r* a little longer than *r*; cell *1st M*₂ long and narrow, widened distally; basal deflection of *Cu*₁ beyond the fork of *M*, the distance about equal to *r-m*. Abdomen coal-black. Male hypopygium with the pleural appendages complex, consisting of three appendages; the outermost

one is an elongate cylindrical rod that terminates in a curved chitinized hook, the inner face before the hook fringed with erect yellow hairs; the intermediate appendage is a little longer, bearing a sharp spine on the inner face beyond midlength, the surface of this appendage with scattered coarse bristles; the proximal appendage is smaller, irregularly bifid, complicated in structure.

Habitat.—Peru.

Holotype, ♂, Napo River, June 14, 1920 (H. S. Parish).

Teucholabis jocos Alexander.

1913. *Teucholabis jocos* Alexander, Ent. News, vol. 24, pp. 440, 441.

Teffé, Brazil, December 27, 1919 (H. S. Parish).

Yurimaguas, Peru, March 28, 1920 (H. S. Parish).

Napo River, Peru, June 15, 1920 (H. S. Parish).

Teucholabis omissinervis sp. n.

General coloration yellow, the anterior median area of the mesonotal praescutum slightly darkened; legs yellow, only the terminal tarsal segments darkened; wings yellow, unmarked; cell 1st M_2 open by the atrophy of the outer deflection of M_3 .

Male.—Wing 4.4 mm.

Female.—Wing about 4.2 mm.

Head lacking. Pronotum yellow. Mesonotum clear reddish yellow, the anterior median area of the praescutum in some specimens a little darkened. Pleura whitish yellow, a little darker dorsally to produce an indistinct longitudinal stripe. Halteres pale, the knobs a little darker. Legs yellow, the terminal tarsal segments infuscated. Wings with a yellowish tinge, more saturated in the costal region; stigma rather indistinct, yellowish; veins yellow. Membrane with the microtrichiae larger than usual in the genus. Venation: Sc of moderate length, Sc_1 ending just before midlength of R_s ; R_s long, gently arcuated; r on R_{2+3} less than its length beyond the fork of R_s ; cell 1st M_2 open by the atrophy of the outer deflection of M_3 ; petiole of cell 2nd M_2 about equal to the cell; basal deflection of Cu_1 at or a short distance beyond the fork of M . Abdomen brownish yellow. Male hypopygium with the pleural appendages moderately complicated, a long, digitiform hairy lobe and two chitinized blades, the outer of which is acicular, the inner one flattened, shaped somewhat like a pruning knife, the apex blackened.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 7, 1920 (H. S. Parish).

Allotopotype, ♀, April 7, 1920.

Paratopotypes, 3 ♀'s, April 7–10, 1920.

Teucholabis omissinervis is readily told from all described species of the genus by the open cell 1st M_2 .

Teucholabis parishi Alexander.1913. *Teucholabis parishi* Alexander, Psyche, vol. 20, pp. 46, 47.

The unique type of this species was taken at Igarapé Assú, Brazil, January 30, 1912 (H. S. Parish).

Teucholabis persimilis Alexander.1920. *Teucholabis persimilis* Alexander, Journ. N. Y. Ent. Soc., vol. 28, pp. 6, 7.

The unique type of *T. persimilis* was taken at Igarapé Assú, Brazil, July 15, 1919 (H. S. Parish).

Genus **TRENTEPOHLIA** Bigot.

Trentepohlia is well represented in tropical America, almost all the species belonging to the subgenus *Paramongoma* Brunetti.

Trentepohlia (Paramongoma) extensa (Alexander)1913. *Mongoma extensa* Alexander, Proc. U. S. Nat. Mus., vol. 44, pp. 501, 502.

Obidos, Brazil, August 27–September 20, 1919 (H. S. Parish).

Parintins, Brazil, October 10, 1919 (H. S. Parish).

Itacoatiara, Brazil, October 17, 1919 (H. S. Parish).

Specimens of this species and *T. longifusa* were sent to Mr. Edwards for comparison with Williston's types. He points out the following differences between the present species and *Trentepohlia manca* (Williston).

"*T. manca* (Williston). Thorax bright ochreous, almost orange. Legs light brown. Wings with a suggestion of clouding along the veins towards the apex and on the crossveins. R_2 longer and more oblique, cell R_2 distinctly stalked; branches of Cu diverging at an angle of about 150° ; 2nd A longer, ending distinctly beyond the anal angle; cell 2nd A broader.

"*T. extensa* (Alexander). Thorax dull brown. Legs darker brown. Wings clear except for stigma. R_2 shorter; cell R_2 sessile; angle of Cu at most 120° ; 2nd A shorter, ending at the barely perceptible anal angle.

"I should consider the two species distinct. Williston had three ♂, one ♀."—F. W. EDWARDS.

Trentepohlia (Paramongoma) longifusa (Alexander)1913. *Mongoma longifusa* Alexander, Proc. U. S. Nat. Mus., vol. 44, p. 502.

The type locality is Igarapé Assú, Brazil, January 19, 1912 (H. S. Parish). One other specimen was taken at Pratá, June 30, 1919 (H. S. Parish). This latter specimen was sent to Mr. F. W. Edwards, of the British Museum, who very kindly compared it with the type of *T. pallida* (Williston). Mr. Edwards writes as follows:

"*T. longifusa* differs from *T. pallida* Will. as you have indicated, and also in the much darker legs and wing veins. It is also rather

smaller, but no other differences are obvious. Nevertheless, I should say quite distinct."—F. W. EDWARDS.

Trentepohlia (Paramongoma) geniculata (Alexander)

1914. *Mongoma geniculata* Alexander, Trans. Am. Ent. Soc., vol. 40, p. 247.

One female from Pratá, Brazil, July 4, 1919 (H. S. Parish). The species had been known only from British Guiana.

Trentepohlia (Paramongoma) pallipes (Alexander)

1914. *Mongoma pallipes* Alexander, Trans. Am. Ent. Soc., vol. 40, pp. 247, 248.

Teffé, Brazil, December 16, 1919 (H. S. Parish). Like the last, *T. pallipes* had previously been known only from British Guiana.

Trentepohlia (Paramongoma) fuscipes sp. n.

Wings with the costal and apical cells strongly infumed; legs entirely dark brown; abdominal tergites dark brown, the sternites paler.

Male.—Length 7.8 mm.; wing 7.7 mm.

Rostrum and palpi yellowish. Antennae with the scapal segments brownish yellow; flagellum dark brown. Front pale brown, whitish pruinose; vertex dark brown. Mesonotal praescutum reddish brown, with two indistinct narrow brown lines; scutum obscure yellow, the lobes dark brown; scutellum and postnotum dark brown. Pleura brownish yellow. Halteres pale brown, the knobs darker. Legs with the coxae and trochanters yellowish testaceous; remainder of the legs uniformly dark brown, the tarsi insensibly paler. Wings subhyaline; stigma small, subcircular, dark brown; cells *C* and *Sc* brown; cells *2nd R*₁, *R*₂, *R*₃ and the outer two-thirds of *R*₅ strongly infumed; a broad brown seam along *R*₅; basal half of cell *M* brownish, this color continued distad along vein *Cu*; cord and outer end of cell *1st M*₂ narrowly and indistinctly seamed with brown; veins dark brown. Venation: almost exactly as in *T. pallipes* (Alexander). Abdomen with the tergites dark brown; hypopygium and sternites brownish yellow.

Habitat.—Brazil.

Holotype, ♂, Teffé, December 19, 1919 (H. S. Parish).

Trentepohlia fuscipes belongs to the *bromeliadicola* group of the genus despite its uniformly darkened legs. The wing-pattern and venation agree closely with *T. pallipes* (Alexander).

Trentepohlia (Paramongoma) femorata sp. n.

Wings subhyaline, the sector and vein *Cu* broadly seamed with brown; wing apex indistinctly darkened; legs dark brown, the femoral tips narrowly but distinctly brownish yellow; abdomen dark brown, segments two to four with the apical half broadly obscure yellowish.

Female.—Length 12.5 mm.; wing 9 mm.

Rostrum and palpi brown. Antennae dark brown, the basal scapal segment sparsely pruinose. Head pale brownish yellow. Mesonotal praescutum reddish brown, with three rather ill-defined darker brown stripes, confluent behind; scutum and scutellum dark brown, the latter narrowly margined with pale; postnotum dark brown, sparsely gray pruinose. Pleura reddish brown, the mesepisternum darker brown. Halteres brown, the base of the stem more yellowish. Legs with the coxae yellowish testaceous; trochanters brownish yellow, the posterior pair darker, the margins of the trochanters narrowly chitinated; femora dark brown, only the apices narrowly (0.7 mm.) brownish yellow; remainder of the legs dark brown. Wings subhyaline; stigma subcircular, dark brown; cell *C* yellowish; *Sc* yellow basally, thence passing into dark brown; broad brown seams along *Rs*, *Cu*, the cord and outer end of cell 1st *M*₂; a very faint brown tinge over the wing-apex, continued basad in cell *R*₃; veins dark brown. Venation: *Sc*₁ longer than *r*; *Rs* slightly angulated before midlength; *r* connecting with *R*₂₊₃ and *R*₁, the tip of the latter a little greater than that section of *R*₂₊₃ beyond *r*; cell 1st *M*₂ pentagonal, moderately long; vein *M*₃ beyond cell 1st *M*₂ much longer than this cell; basal deflection of *Cu*₁ just before the fork of *M*; distance on wing-margin between veins *Cu*₂ and 1st *A* a little more than one-half *m*. Abdomen dark brown, the apical half of segments two to four broadly obscure reddish; ovipositor pale at the base; tergal valves rather short, deep wine-brown in color, slightly upcurved, the tips acute.

Habitat.—Brazil.

Holotype, ♀, Tefé, December 24, 1919 (H. S. Parish).

Trentepohlia femorata is readily told from all described American species of the genus by the coloration of the legs.

***Trentepohlia (Paramongoma) flavella* sp. n.**

Sex?—Wing 3.4 mm.

Related to *T. (P.) pallida* (Williston) but readily distinguished by the following characters: Size very small, by far the smallest American species of the genus as yet made known. Legs pale throughout. Wings with a very strong grayish yellow tinge, the costal region brighter yellow; veins conspicuous yellow; stigma indistinct, only slightly darker than the surrounding membrane; macrotrichiae on the veins very sparse—a series on costa for its entire length; a few on the end of *R*₁, others on *M*₁₊₂ and others scattered on various veins. Venation: *Sc* long, ending just before the fork of *Rs*; *Sc*₂ rather indistinct, slightly removed from the tip of *Sc*₁; *r* near the tip of *R*₁, connecting with *R*₂₊₃ beyond two-thirds its length; cell 1st *M*₂ large, longer than vein *M*₃ beyond it; *m* about one-half the outer deflection of *M*₃; basal deflection of *Cu*₁ a short distance before the fork of *M*; *Cu*₂ widely separated from 1st *A* at the wing-margin, this distance being approximately as long as *Cu*₂ alone; some of the veins are very faint and evidently in

process of atrophy, such being all the veins beyond cell 1st M_2 except R_4+5 ; most of the veins distad of the cord are very weak and entirely without macrotrichiae.

Habitat.—Brazil.

Holotype, Sex?, Teffé, December 26, 1919 (H. S. Parish).

Genus **TOXORHINA** Loew.

1851. *Toxorhina* Loew, Linnaea Entomol., Bd. 5, p. 400.

Toxorhina is a very characteristic genus in the Amazonian fauna. There has been some attempt made to restrict the name *Toxorhina* Loew to the species of the genus that we call *Elephantomyia* Osten Sacken. The basis for this reference consists in a preliminary paper (Bernst. und Bernst.-fauna, 1850) by Loew in which the genus *Toxorhina* is briefly characterized and keyed and three species belonging to it are mentioned but not described. There are at least three genera to which Loew's diagnosis would apply and his genus would be unrecognizable were it not for a more detailed account with figures that appeared in 1851, as cited above. In this paper, in addition to the three amber species which are briefly discussed and figured, there appears in this paper a full description, with many figures, of the recent *T. fragilis* Loew of Porto Rico, which species Coquillett selected as type of *Toxorhina* in 1910. In the opinion of the writer, the 1850 name *Toxorhina* has no more status than the famous 1800 names of Meigen, since it must depend entirely on the 1851 paper for its accurate diagnosis and recognition. If this latter fact is admitted then there can be no valid objection against selecting any of the species included in this paper as type as was done by Coquillett. Unless further and more convincing arguments are brought forth, the writer will follow the generic concepts as advocated by Osten Sacken and other later students of the Tipulidae.

It has long been held that *Elephantomyia* and *Toxorhina* are closely allied. The former genus possesses small but distinct tibial spurs which appear to be quite lacking in the species of *Toxorhina*. For the time being, at least, the writer is referring *Toxorhina* to the Eriopterini. The discovery of the immature stages is very desirable.

Toxorhina brasiliensis (Westwood)

1835. *Limnobiaorhynchus brasiliensis* Westwood, Ann. Soc. Ent. France, Tome 4, p. 683.

Itacoatiára, Brazil, October 16–21, 1919 (H. S. Parish).

Teffé, Brazil, December 22–27, 1919 (H. S. Parish).

Toxorhina centralis (Alexander)

1913. *Toxorhina centralis* Alexander, Psyche, vol. 20, pp. 52, 53.

Igarapé Assú, Brazil (H. S. Parish).

Teffé, Brazil, January 20, 1920 (H. S. Parish).

Toxorhina meridionalis (Alexander)

1913. *Toxorhina meridionalis* Alexander, Psyche, vol. 20, pp. 51, 52.

Igarapé Assú, Brazil, January 26–February 4, 1912 (H. S. Parish).

Flores, Brazil, November 14–19, 1919 (H. S. Parish).

Toxorhina flavida (Alexander)

1913. *Toxorhina flavida* Alexander, Psyche, vol. 20, p. 51.

Igarapé Assú, Brazil, February 1–7, 1912 (H. S. Parish).

Napo River, Peru, June 15, 1920 (H. S. Parish).

Genus **CERATOCHEILUS** Wesché.

1910. *Ceratocheilus* Wesché, Journ. Linn. Soc., Zool., vol. 30, p. 358.

Ceratocheilus americanum Alexander.

1913. *Ceratocheilus americanum* Alexander, Psyche, vol. 20, pp. 49, 50.

Igarapé Assú, Brazil, January 30, 1912 (H. S. Parish).

Genus **SIGMATOMERA** Osten Sacken.

1869. *Sigmatomera* Osten Sacken, Mon. Dipt. N. Amer., pt. 4, p. 137.

Sigmatomera amazonica Westwood.

1881. *Sigmatomera Amazonica* Westwood, Trans. Ent. Soc. Lond., pt. 3, pp. 366, 367.

The type of this beautiful crane-fly was taken in Amazonia by Bates. The allotype female was described by the writer (Can. Ent., vol. 52, pp. 142, 143; 1920) from material taken at Flores, Brazil, November 12, 1919 (H. S. Parish).

Genus **LECTERIA** Osten Sacken.

1887. *Lecteria* Osten Sacken, Berl. Ent. Zeitsch., Bd. 31, pt. 2, p. 206.

Lecteria armillaris (Fabricius)

1805. *Tipula armillaris* Fabricius, Syst. Antl., p. 26.

Igarapé Assú, Brazil, January 29–30, 1912 (H. S. Parish).

Manáos, Brazil, October 31–November 4, 1919 (H. S. Parish).

Flores, Brazil, November 12–19, 1919 (H. S. Parish).

Iquitos, Peru, March 17–May 4 to 21, 1920 (H. S. Parish).

Yurimaguas, Peru, April 1–22, 1920 (H. S. Parish).

Genus **BRACHYPREMNA** Osten Sacken.

1886. *Brachypremna* Osten Sacken, Berl. Ent. Zeitsch., Bd. 30, p. 161.

Brachypremna candida Alexander.

1912. *Brachypremna candida* Alexander, Journ. N. Y. Ent. Soc., vol. 20, p. 234.

Manáos, Brazil (Miss Merrill).

Teffé, Brazil, December 22–26, 1919 (H. S. Parish).

Iquitos, Peru, May 25–June 15, 1920 (H. S. Parish).

Yurimaguas, Peru, March 31, 1920 (H. S. Parish).

Napo River, Peru, June 14–15, 1920 (H. S. Parish); August 3, 1920 (Native Collector).

A few additional details concerning the leg pattern may be given: The black of the tibiae is very extensive on the fore and middle legs, only the narrow bases and slightly broader apices being yellowish white. On the posterior tibiae, however, the apical one-half or more is whitish, the dark area being a comparatively narrow ring (5 to 6 mm.) wide, ending before midlength of the sclerite.

Brachyremna breviventris (Wiedemann)

1821. *Tipula breviventris* Wiedemann, Dipt. Exot., Bd. 1, p. 43.

Igarapé Assú, Brazil (H. S. Parish).

Teffé, Brazil, December 25, 1919 (H. S. Parish).

Yurimaguas, Peru, April 5–6, 1920 (H. S. Parish).

Brachyremna williamsoni Alexander.

1912. *Brachyremna williamsoni* Alexander, Journ. N. Y. Ent. Soc., vol. 20, pp. 231, 232.

Pratá, Brazil, July 2, 1919 (H. S. Parish).

Parintins, Brazil, October 2, 1919 (H. S. Parish).

Manáos, Brazil (Miss Merrill); paratype.

Flores, Brazil, November 6–12, 1919 (H. S. Parish).

Teffé, Brazil, December 12, 1919 (H. S. Parish).

Santo Antonio, Brazil, February 16, 1920 (H. S. Parish).

Iquitos, Peru, May 25, 1920 (H. S. Parish).

Brachyremna dispellens (Walker)

1860. *Tipula dispellens* Walker, Trans. Ent. Soc. Lond., n. ser., vol. 5, p. 334.

Igarapé Assú, Brazil, 1912 (H. S. Parish).

Pratá, Brazil, July 9, 1919 (H. S. Parish).

Brachyremna uniformis Alexander.

1920. *Brachyremna uniformis* Alexander, Ent. News, vol. 31, p. 75.

Parintins, Brazil, October 8, 1919 (H. S. Parish).

Manáos, Brazil, November 1, 1919 (H. S. Parish).

Flores, Brazil, November 15, 1919 (H. S. Parish).

Iquitos, Peru, May 17, 1920 (H. S. Parish).

Brachyremna basilica sp. n.

Similar to *B. candida* Alexander but very much larger (wing of male over 20 mm.); palpi yellow, the terminal segment abruptly dark brown with the extreme tip orange; tarsi light yellow, the

tibial tips concolorous, broadest on the posterior legs, wings with a brownish tinge, the stigma with a pale center.

Male.—Length 17.5–18 mm.; wing 22–24.5 mm.

Fore leg, femur, 13.6 mm.; tibia, 17.7 mm.; middle leg, femur, 16.3 mm.; tibia, 17.8 mm.; hind leg, femur, 16.4 mm., tibia, 18.6 mm. Frontal prolongation of the head light yellow above, including the nasus; dark brown laterally; mouthparts dark brown, palpi with the three basal segments light yellow, the terminal segment abruptly dark brown with the extreme tip dull orange. Antennae short, the scape yellow; flagellar segments bicolorous, the base of each segment dark brown, the apex broadly yellow; terminal flagellar segments more unicolorous. Head brown, more yellowish anteriorly. Mesonotal praescutum brown with four very indistinct darker brown stripes, the intermediate pair very indistinctly separated from one another; an obscure yellow lateral spot on the sides of the sclerite before the suture; scutal lobes dark brown, the median area paler; scutellum and postnotum dark brown. Pleura light brown, spotted with darker brown. Halteres brown, the knobs darker. Legs with the coxae yellowish testaceous, the outer face variegated with darker; trochanters yellow; femora dark brown, the bases paler, the tips rather broadly (1.3 mm.) whitish yellow; tibiae dark brown, the bases whitish yellow, co-extensive with the pale femoral tips, the tips fading into dull yellow, narrowest (3.5 mm.) on the fore legs, broadest (9 mm.) on the hind legs; tarsi dull yellow. Wings with a strong brownish tinge, most intense in cells *C* and *Sc*; stigma ocelliform, dark brown, the center pale, occupying the end of cell 1st *R*₁; veins conspicuously seamed with brown; veins dark brown. Venation: tip of *R*₁ perpendicular to the remainder of the vein; *Sc*₁ long, extending almost to the tip of *R*₁; *Rs* strongly arcuated at origin; deflection of *R*₄₊₅ distinct; petiole of cell *M*₁ shorter than *m*; vein 2nd *A* very short. Abdominal tergites brown, the bases of each segment narrowly pale; sternites obscure yellow, each sclerite with a linear black mark occupying about the distal half of each segment.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, March 31, 1920 (H. S. Parish).

Paratopotype, ♂.

Brachypremna basilica is one of the largest and most conspicuous species of the genus yet described. In the pattern of the legs, it closely parallels *B. candida* Alexander, but in other respects the two insects have little in common.

Genus **TANYPREMNA** Osten Sacken.

1886. *Tanypremna* Osten Sacken, Biol. Cent. Am., Dipt., vol. 1, p. 19.

Tanypremna longipes (Fabricius)

1805. *Tipula longipes* Fabricius, Syst. Antl., p. 25.

Manáos, Brazil (W. M. Mann).

Yurimaguas, Peru, March 29–April 20, 1920 (H. S. Parish).

Genus **MEGISTOCERA** Wiedemann.

1828. *Megistocera* Wiedemann, Aussereur. zweifl. Ins., Bd. 1, p. 55.

Megistocera longipennis (Macquart)

1838. *Tipula longipennis* Macquart, Dipt. exot., Tome 1, pt. 1 p. 57.

Obidos, Brazil, September 23, 1919 (H. S. Parish).

Yurimaguas, Peru, April 8, 1920 (H. S. Parish).

Genus **OZODICERA** Macquart.

1834. *Ozodicera* Macquart, Suites à Buffon, Tome 1, Hist. Nat. Ins., Dipt., p. 92.

Ozodicera (Dihexaclonus) triguttata sp. n.

Flagellar segments two to seven pale yellowish brown, each with two short, pale pectinations; mesonotum light brown, the praescutum with four slightly darker stripes; femora broadly tipped with brownish black; wings reddish brown with three dark brown spots, situated at the origin of *Rs* and along the cord; abdomen reddish brown, the lateral margins of the tergites darker; apices of the ninth sterno-pleurite of the male hypopygium produced into slender spatulate blades.

Male.—Length 26.5 mm.; wing 22 mm.; abdomen alone, 18.5 mm.

Frontal prolongation of the head brown; palpi dark brown. Antennae with the scape and pectinated flagellar segments pale yellowish brown, the terminal flagellar segments dark brown, flagellar pectinations pale, a very little longer than the segments that bear them. Head reddish brown; vertex between the eyes very narrow, as in the genus. Mesonotum light brown, the praescutum with four very slightly darker, indistinct stripes; median area of the scutum, scutellum and postnotum dark brown. Pleura light brown, sparsely pruinose. Halteres dark brown. Legs with the coxae pale brownish yellow; trochanters light yellow; femora brownish yellow, the tips broadly and conspicuously brownish black; tibiae brownish yellow, the tips narrowly dark brown; tarsi dark brown. Wings with a very strong reddish brown tinge, more saturated in the costal and subcostal cells; base of the wing, in the anal cells, pale, three dark brown spots arranged as follows: a small one at the origin of *Rs*; a large blotch along the cord, extending from the fork of *Rs* to the fork of *M*; the third spot is slightly smaller than the last, at the fusion of *Cu*₁ and *M*₃; stigma pale brownish yellow; veins brownish yellow. Venation as in the genus; tip of *R*₁ atrophied; tip of *R*₂ semiatrophied, pale; fusion of *Cu*₁ and *M*₃ about equal to *r-m*. Abdomen dark reddish brown, the lateral margins of the tergites broadly darker brown, narrowly interrupted at the caudal margins of the segments; sternites brownish yellow. Male hypopygium with the sterno-pleurite produced caudad into slender spatulate blades that are subequal in length to the outer pleural appendage.

Habitat.—Brazil.

Holotype, ♂, Teffé, January 1, 1920 (H. S. Parish).

Ozodicera triguttata is distinguished from the other members of the subgenus by its large size and comparatively heavily spotted wings. It is closest to *O. (D.) fumipennis* Loew, likewise from Brazil, in which the male measures between 17 and 18 mm. in length, the antennal flagellum is almost black, the wings dark yellowish brown with only a smoky black cloud at *r-m* and with the body coloration different.

***Ozodicera (Ozodicera) noctivagans* Alexander.**

1914. *Ozodicera noctivagans* Alexander, Trans. Amer. Ent. Soc. vol. 40, pp. 253, 254.

♀, Pará, Brazil, June 7, 1919 (H. S. Parish).

♂ ♀, Flores, Brazil, November 10–19, 1919 (H. S. Parish).

The female sex has not been described and one of the present specimens is made the allotype.

Allotype, ♀, length 15 mm.; wing 11.8 mm.

Generally similar to the male, differing as follows: Flagellar pectinations a little shorter than in the male, the longest being about as long as the segments that bear them. Abdominal tergites brownish yellow with a narrow median line and narrow lateral margins dark brown. Ninth tergite dark brown. Sternites uniformly yellow. Ovipositor with the tergal valves long and slender; sternal valves shorter, compressed.

Allotype.—♀, Flores, Brazil, November 19, 1919 (H. S. Parish).

***Ozodicera (Ozodicera) extensa* sp. n.**

Antennal pectinations long, each strongly bent at about one-third its length, at the angle with a short spur that bears a bristle; mesonotal praescutum brown, the stripes very indistinct; wings strongly brownish, the costal and subcostal cells darker; a dark brown cloud at the fork of *Rs*; male hypopygium with the lobes of the tergite provided with brushes of long yellow hairs; each sterno-pleurite produced caudad into a long, slender, chitinized rod that is dilated into a spinulose apex, at the extreme tip bearing a spine.

Male.—Length 15.5 mm.; wing 13.6 mm.

Frontal prolongation of the head brown; palpi dark brown. Antennae uni-pectinate, scapal segments obscure yellow, flagellar segments brown, the pectinations dark brown; flagellar pectinations elongate, each strongly bent at about one-third the length, at the angle with a slight spur that is tipped with a small bristle. Head brown. Mesonotal praescutum brown, the stripes very indistinct; scutellum and postnotum gray pruinose. Pleura pale brown, gray

pruinose; dorso-pleural region dark brown. Halteres brown. Legs with the coxae and trochanters testaceous; femora obscure yellow, the tips broadly dark brown; tibiae similar, the tips narrowly dark brown; tarsi dark brown. Wings with a strong brownish tinge, the costal and subcostal cells dark brown; stigma oval, dark brown; a dark brown cloud at the fork of *Rs* and along the cord to the fork of *M*. Venation: *Rs* strongly arcuated at origin, a little longer than *R*₂₊₃; basal deflection of *M*₁₊₂ a little shorter than that of *M*₃₊₄; *m* about three times the deflection of *M*₂. Abdomen dark brown, the basal sternites obscure yellow; hypopygium brownish yellow. Male hypopygium with the ninth tergite having a deep, V-shaped notch, each lobe with a dense brush of long light yellow bristles. Each sterno-pleurite produced caudad into a long, chitinized blackened rod, the apex slightly dilated, spinulose, the extreme apex with a large and conspicuous conical spine; pleural appendage a simple curved arm, slightly dilated at the base, gradually narrowed to the apex.

Habitat.—Brazil.

Holotype, ♂, Teffé, January 9, 1920 (H. S. Parish).

Ozodicerca (Ozodicerca) attenuata Alexander.

1920. *Ozodicerca attenuata* Alexander, Journ. N. Y. Ent. Soc., vol. 28, pp. 8, 9.

Pratá, Brazil, July 5, 1919 (H. S. Parish); type.

Flores, Brazil, November 15, 1919 (H. S. Parish).

Ozodicerca (Ozodicerca) bispinifer sp. n.

Antennal pectinations short, the longest about equal to the segments that bear them; mesonotum brown, the four narrow stripes more reddish brown; pleura buffy brown, sparsely pruinose; legs brown, the tips of the segments not distinctly darkened; wings brown, the costal and subcostal cells more yellowish; male hypopygium with the inner pleural appendage very complex, the lateral portions produced into two conspicuous parallel reddish spines; proximal portion of the appendage a slender blade that juts toward the notch of the ninth tergite.

Male.—Length 22 mm.; wing 18 mm.

Frontal prolongation of the head brown, darker laterally; nasus stout; palpi dark brown. Antennal scape obscure yellow; flagellum dark brown, the first segment paler basally; flagellar segments two to seven unipectinate, the longest branches about equal to the segments that bear them. Head brown. Mesonotal praescutum brown with four narrow reddish brown stripes, the intermediate pair narrowly separated from one another, each gradually narrowed behind, ending before the suture; remainder of the mesonotum brown, sparsely pruinose. Pleura light buff-brown, sparsely gray pruinose. Halteres dark brown, the base of the stem a little paler. Legs with the coxae concolorous with the thoracic pleura; trochanters

obscure yellow; remainder of the legs brown, the tarsi darker. Wings with a strong brownish tinge, the costal and subcostal cells more yellowish; stigma oval, brown; veins brown. Venation: R_s longer than R_{2+3} ; $r-m$ about one-half the deflection of R_{4+5} ; deflection of M_2 a little longer than $r-m$; basal deflection of M_{3+4} about one-half longer than the deflection of M_{1+2} . Abdomen light brown, the basal tergite gray pruinose, eighth segment darker brown; tergites with an indistinct sublateral stripe. Male hypopygium having the ninth tergite with a very large U-shaped median notch, the lateral lobes but feebly provided with bristles. Outer pleural appendage slender at the base, at the apex dilated into a flattened blade; inner pleural appendage complex, the lateral portion produced into two long, parallel, reddish spines, the caudal margin of the posterior spine with a single row of setigerous tubercles, each tubercle bearing a long yellow bristle, the outermost tubercle enlarged into a slender tooth; proximal portion of the appendage produced into a slender, arm-like blade that juts towards the notch of the ninth tergite.

Habitat.—Brazil.

Holotype, ♂, Teffé, February 3, 1920 (H. S. Parish).

Genus **MICROTIPULA** Alexander.

1912. *Microtipula* Alexander, Ann. Ent. Soc. Amer., vol. 5, pp. 360, 361.

Microtipula amazonica Alexander.

1912. *Microtipula amazonica* Alexander, Ann. Ent. Soc. Amer., vol. 5, pp. 361, 362.

The types were collected at Igarapé Assú, Brazil, January 27–29 1912 (H. S. Parish).

Genus **TIPULA** Linnaeus.

1758. *Tipula* Linnaeus, Syst. Nat., edit. 10, p. 585.

Tipula parishi Alexander.

1912. *Tipula parishi* Alexander, Ann. Ent. Soc. Amer., vol. 5, pp. 355, 356.

The type was taken at Igarapé Assú, Brazil, January 26, 1912 (H. S. Parish).

Tipula diacanthos sp. n.

Belongs to the *monilifera* group; antennal flagellum uniformly brownish black; general coloration shiny yellow, the abdomen with a subterminal black ring; wings yellowish gray, the costal and subcostal cells brighter; male hypopygium with the ninth tergite tridentate; eighth sternite very large, terminating in two conspicuous spines that are directed caudad and dorsad.

Male.—Length 15.5 mm.; wing 14.2 mm.; antenna 11 mm.

Frontal prolongation of the head very stout, comparatively short, yellow, the dorsal surface with erect black hairs that terminate in a tuft at the apex of the stout nasus; palpi elongate, pale brownish

yellow, the tip of the terminal segment dark brown. Antennae of the male elongate; scape and first flagellar segment obscure yellow; flagellar segments dark brown, the extreme tips of the segments a little paler; basal enlargements of the segments conspicuously globular as in the *monilifera* group. Head brownish yellow. Mesonotal praescutum shiny testaceous yellow with three indistinct reddish stripes; remainder of the mesonotum testaceous yellow. Pleura shiny yellow. Halteres yellow, the knobs a little darker. Legs with the coxae shiny yellow; trochanters yellow; femora brownish yellow, the extreme tips narrowly and indistinctly darkened; tibiae yellowish brown; tarsi dark brown. Wings with a yellowish gray suffusion, cells *C*, *Sc* and the wing-base more saturated yellow; stigma oval, pale brown; veins dark brown. Venation: *Sc*₂ extending to just before midlength of *R*₅; *R*₅ very gently arcuated to nearly straight, about equal to *R*₂+₃; cell *R*₂ comparatively small, *R*₂+₃ in alignment with *R*₃; cell 1st *M*₂ elongate-pentagonal; petiole of cell *M*₁ about one-half longer than *m*; *m-cu* distinct. Abdomen obscure brownish yellow, the basal tergites and the sternites brighter; eighth sternite and bases of eighth tergite and ninth sternite black; hypopygium reddish yellow. Male hypopygium with the caudal margin of the ninth tergite tridentate, the median lobe more acute than the subequal lateral lobes; apex of the median lobe directed slightly dorsad, of the lateral lobes slightly ventrad. Ninth sternopleurite very reduced, not at all conspicuous. Eighth sternite very extensive, jutting caudad of the level of the other elements of the hypopygium, broad, the caudal lateral angles produced caudad into two very conspicuous spines that are directed caudad and dorsad; immediately cephalad of each of these lobes is a smaller conical tooth.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, March 31, 1920 (H. S. Parish).

Tipula armatipennis napoensis subsp. n.

Allied to *T. armatipennis*; head pale yellow, the vertex with a narrow brown median line; general coloration fulvous yellow; wings yellowish gray, the costal and subcostal cells more saturated; *R*₂ subperpendicular to the tip of *R*₂+₃; valves of the ovipositor subfleshy.

Female.—Length 18 mm.; wing 14.5 mm.

Frontal prolongation of the head obscure yellow; palpi elongate, especially the terminal segment, pale yellow. Antennae bicolorous; scape and first flagellar segment obscure yellow; remaining flagellar segments with the basal swelling black, the remainder of each segment brownish yellow, on the terminal segments darkening to yellowish brown. Head pale yellowish, the vertex with a narrow brown median line. Mesonotum light yellow, without darker markings of any kind. Pleura light yellow. Halteres brownish yellow, the knobs dark brown. Legs with the coxae and trochanters light

yellow; femora brownish yellow, a little darkened apically; tibiae light brown, the tips narrowly darkened; tarsi brown. Wings with a strong yellowish gray tinge, darkest in the cells beyond the cord; cells *C*, *Sc* and the wing-base more saturated yellow; stigma sub-circular, brown; veins brown. Venation: *Sc*₂ extending to about opposite two-thirds *Rs*, the latter short, almost straight, feebly angulated near one-fourth its length; *R*₂₊₃ a little shorter than *Rs*; *R*₂ short, straight, at a strong angle (65°) to *R*₂₊₃; *r* practically eliminated by atrophy; *R*₃ very long, nearly three times *R*₂₊₃; cell 1st *M*₂ rather small, pentagonal; petiole of cell *M*₁ about two-fifths cell *M*₁, nearly three times *m*; *m-cu* barely evident. An obliterative streak before the stigma, extending across the base of cell 1st *M*₂, from *R*₁ into the base of *M*₄. Abdominal tergites brownish yellow, the dorso-median area broadly, the lateral margins very narrowly, darker; sternites yellow. Ovipositor moderately elongate, very much smaller than the preceding segments; tergal valves stout, compressed, slightly narrowed before the obtusely rounded tips; sternal valves flattened, the tips obliquely truncated.

Habitat.—Peru.

Holotype, ♀, Napo River, June 15, 1920 (H. S. Parish).

Based on the structure of the female, the present insect must be considered as being a race of *armatipennis* Alexander (Chapáda, Brazil) but the discovery of the male might result in giving the form full specific rank. In typical *armatipennis* the flagellar segments are a little longer, there is no dark line on the vertex, the thoracic coloration is more fulvous and the structure of the ovipositor is slightly different.

***Tipula bezziana* sp. n.**

Frontal prolongation of the head very short, stout, nasus lacking; head yellow, the inner margins of the eyes broadly margined with black; mesonotum obscure brownish yellow, the praescutum with a broad black median stripe; wings hyaline, cells *C*, *Sc* and the stigma dark brown; wing-tip darkened; *Rs* short, strongly arcuated; cell 1st *M*₂ large, subquadrate; fusion of *Cu*₁ and *M*₃ extensive; abdomen of female elongate.

Female.—Length 15–18 mm.; wing 10.2–10.3 mm.

Frontal prolongation of the head very short, entirely without a nasus, yellow, more brownish dorsally and here provided with conspicuous black bristles; palpi brown. Antennae short, scapal segments yellowish testaceous; flagellar segments dark brown with long verticils. Head yellow, the vertex adjoining the inner margins of the eyes broadly black, restricting the ground-color to a comparatively narrow median stripe on the vertex, broadening on the occiput. Pronotum yellow. Mesonotal praescutum obscure brownish yellow with a broad dark brown median stripe, the lateral stripes indistinct; pseudosutural foveae distinct; scutal lobes brownish

black; scutellum brown; postnotum brownish yellow, the median area broadly black. Pleura testaceous yellow. Halteres yellowish brown, the knobs dark brown. Legs with the coxae concolorous with the thoracic pleura; trochanters with a faint greenish tinge; femora brown, testaceous basally, passing into dark brown at their tips; remainder of the legs dark brownish black; claws simple. Wings hyaline, the costal cell brown, the subcostal cell dark brown; stigma dark brown; wing-apex broadly darkened; veins beyond the cord broadly seamed with brown; veins brownish black; veins, with the exception of *C* and *R*, destitute of macrotrichiae. Venation: *Sc* ending opposite or slightly beyond the fork of *Rs*, *Sc*₁ indistinct, *Rs* very short, arcuated, less than $R_2 + r$; tip of *R*₂ preserved but weak; *R*₃ more than twice $R_2 + r$; *r-m* short to very short; cell 1st *M*₂ very large, roughly quadrate; petiole of cell *M*₁ shorter than *m*; fusion of *Cu*₁ with *M*₃ extensive, about equal to the petiole of cell *M*₁; 2nd Anal vein straight, not close to the axillary margin. Abdomen elongate in the female; basal tergites dark brown, each segment with a narrow yellowish transverse band shortly before midlength of the segment; sternites obscure yellow, terminal segments uniformly dark brownish black. Ovipositor with the valves chitinated; tergal valves straight, considerably exceeding the sternal valves.

Habitat.—Peru.

Holotype, ♀, Yurimaguas, April 10, 1920 (H. S. Parish).

Paratopotype, ♀, March 23, 1920.

Tipula bezziana is a strikingly beautiful fly that is probably not a true *Tipula* but there is no genus known to the writer that can receive it. The very short frontal prolongation of the head, without a nasus, is very like *Nephrotoma*, whereas the venation is somewhat suggestive of *Brachypremna*. The discovery of the male sex will be of exceptional interest. It is with great pleasure that this interesting species is dedicated to my friend, the distinguished Dipterologist, Dr. Mario Bezzi.

***Tipula effeta* sp. n.**

General coloration grayish brown, the pleura testaceous; antennae of the male elongated, flagellum black; wings with a brownish tinge, the costal region and the stigma darker; inner pleural appendage of the male hypopygium terminating in two stout spines.

Male.—Length 12 mm.; wing 11.5 mm.

Female.—Length 12 mm.; wing 12.4 mm.

Frontal prolongation of the head short, obscure yellow, darker brown dorsally; palpi dark brown. Antennae of the male elongated, if bent backward extending to beyond midlength of the second abdominal segment; scapal segments testaceous, flagellum black, the segments elongate, covered with a delicate white pubescence

and provided with a few long bristles. Head dark brown, narrowly paler adjoining the inner margin of the eyes. Mesonotum uniformly grayish brown, the postnotum more plumbeous. Pleura testaceous. Halteres dark brown. Legs with the coxae yellowish testaceous, trochanters obscure yellow; femora brown, paler basally; tibiae and tarsi dark brown. Wings with a strong brownish tinge, especially in the cells beyond the cord; cells *C*, *Sc* and the stigma darker brown; veins dark brown; a pale area immediately before the stigma; wings petiolate. Venation: *Sc*₂ ending opposite two-thirds *Rs*; *Rs* long, arcuated near its extreme origin, slightly more than one-half longer than *R*₂₊₃; cell 1st *M*₂ elongate pentagonal; petiole of cell *M*₁ nearly twice *m*; vein 2nd *A* close to the posterior margin, cell 2nd *A* being very narrow. Abdominal tergites dark brown; sternites and hypopygium obscure brownish yellow. Male hypopygium of simple structure, the ninth tergite ending in a median conical lobe that is heavily blackened; inner pleural appendage terminating in two acute stout spines, in addition to an apical, very slender, curved spine.

Habitat.—Peru.

Holotype, ♂, Yurimaguas, April 1, 1920 (H. S. Parish).

Allotopotype, ♀, April 23, 1920.

Paratopotype, 3 ♀'s, March 29–April 13, 1920.

Tipula effeta, together with the species next described, *T. plumbeithorax*, is not a typical member of the genus *Tipula* but will probably be found to represent a new genus or subgenus when more and better preserved specimens are available.

***Tipula plumbeithorax* sp. n.**

General coloration dark plumbeous, the pleura light gray pruinose; wings faintly grayish, the stigma dark brown; 2nd *Anal* cell long and narrow.

Female.—Length 15 mm.; wing 12 mm.

Frontal prolongation of the head comparatively short, dark brown above, more yellowish laterally and beneath; nasus short and blunt, bearing several long, black bristles; palpi dark brown. Antennal scape reddish brown, the flagellar segments brownish black, verticillate, one bristle on each segment being longer than the others. Head plumbeous, light gray pruinose. Mesonotum uniformly dark plumbeous, the scutellum and postnotum light gray pruinose. Pleura with a light, blue-gray pruinosity. Halteres dark brown, the base of the stem a little paler. Legs with the fore and middle coxae gray, the posterior coxae reddish testaceous, very sparsely pruinose; trochanters brownish yellow; femora brown, paler basally; remainder of the legs brownish black. Wings with a grayish tinge; stigma conspicuous, dark brown; cell *Sc* light brown; obliterative areas before the stigma, crossing cell 1st *M*₂ into the base of cell *M*₄; veins black; wings petiolate at base. Venation: *Sc* moder-

ately long, Sc_2 extending to just beyond midlength of R_s , Sc_1 lacking, R_s long, arcuated at origin; R_s about one-half longer than R_2+3 ; cell 1st M_2 elongate, pentagonal; petiole of cell M_1 short, about one-half m ; $m-cu$ short but distinct; 2nd Anal vein straight, cell 2nd A being very long and narrow. Abdominal tergites black, sternites more testaceous brown. Ovipositor with the tergal valves rather stout, compressed, the tips broadly and obtusely rounded; sternal valves very short, flattened, the tips obliquely truncated.

Habitat.—Peru.

Holotype, ♀, Iquitos, March 10, 1920 (H. S. Parish).

Tipula plumbeithorax, like *T. effeta*, is an aberrant member of the genus *Tipula* but the material is insufficient upon which to base a new group. The general appearance of the flies suggests *Tanypremna* but the claws are simple.

BIBLIOGRAPHY.

ALEXANDER, CHARLES P.

On the tropical American Rhipidiæ (Tipulidæ, Dipt.). Bull. Brooklyn Ent. Soc., vol. 8, pp. 6-17; 1912.

A new tropical Gonomyia (Tipulidæ, Dipt.). Ent. News, vol. 23, pp. 418-420; 1912.

A revision of the genus Brachypremna Osten Sacken (Tipulidæ, Diptera). Journ. N. Y. Ent. Soc., vol. 20, pp. 225-236; 1912.

New Neotropical Tipulinae (Tipulidæ, Dipt.). Ann. Ent. Soc. Amer., vol. 5, pp. 343-362; 1912.

New Neotropical Antochini (Tipulidæ, Diptera). Psyche, vol. 20, pp. 40-54; 1913.

A synopsis of part of the Neotropical crane-flies of the subfamily Limnobiinae. Proc. U. S. Nat. Mus., vol. 44, pp. 481-549; 1913.

New or little-known Neotropical Hexatomini (Tipulidæ, Diptera). Psyche, vol. 21, pp. 33-45; 1914.

A revision of the American species of Tanypremna Osten Sacken and Megistocera Wiedemann (Tipulidæ, Diptera). Journ. N. Y. Ent. Soc., vol. 22, pp. 205-218; 1914.

New or little-known crane-flies from tropical America (Tipulidæ, Diptera). Can. Ent., vol. 52, pp. 141-144; 1920.

Undescribed Tipulidæ collected by Mr. H. S. Parish in Brazil (Dipt.). Ent. News, vol. 31, pp. 70-75; 1920.

Records and descriptions of Neotropical crane-flies (Tipulidæ, Diptera)—II. Journ. N. Y. Ent. Soc., vol. 28, pp. 1-13; 1920.

OSTEN SACKEN, C. R. R.

Studies on Tipulidæ—Part 1. Review of the published genera of the Tipulidæ longipalpi. Berl. Entomol. Zeitsch., Bd. 30, pp. 153-188; 1886.

Studies on Tipulidæ—Part 2. Review of the published genera of the Tipulidæ brevipalpi. Berl. Entomol. Zeitsch., Bd. 31, pp. 163-242; 1887.

WALKER, FRANCIS

Insecta Saundersiana, vol. 1. Diptera, pp. 1-474; 1850-56.

WESTWOOD, J. O.

Notæ Dipterologicae—No. 5. Descriptions of new species of Exotic Tipulidæ, with an annotated summary of species belonging to the same family, previously described. Trans. Ent. Soc. London, 1881, part 3, pp. 363-385.

EXPLANATION OF PLATE IV.

- Fig. 1. Male hypopygium of *Gonomyia* (*Leiponeura*) *acuminata* sp. n.
Fig. 2. Male hypopygium of *Gonomyia* (*Leiponeura*) *falcifer* sp. n.
Fig. 3. Male hypopygium of *Gonomyia* (*Leiponeura*) *spicata* sp. n.
Fig. 4. Male hypopygium of *Gonomyia* (*Leiponeura*) *bispinosa* sp. n.
Fig. 4A. Pleural appendages of the same; enlarged.
Fig. 5. Male hypopygium of *Gonomyia* (*Leiponeura*) *crepuscula* sp. n.
Fig. 5A. Penis-guard and gonapophyse of the same.
Fig. 6. Male hypopygium of *Gonomyia* (*Leiponeura*) *ctenophora* sp. n.
Fig. 7. Male hypopygium of *Gonomyia* (*Leiponeura*) *phorocenia* sp. n.
Fig. 8. Male hypopygium of *Erioptera* (*Erioptera*) *micromyia* Alexander.
Fig. 9. Male hypopygium of *Dicranomyia* *acuminata* sp. n.
Fig. 10. Male hypopygium of *Dicranomyia* *egae* sp. n.
Fig. 11. Male hypopygium of *Dicranomyia* *napoensis* sp. n.
Fig. 12. Male hypopygium of *Dicranomyia* *rapax* sp. n.

V = Ventral pleural appendage; D = Dorsal pleural appendage; Pl = Pleurite;
Pgd = Penis-guard; Gon = Gonapophyse.

STUDIES ON SOME FLAGELLATA.

BY E. PENARD.

While studying Infusoria, in the neighborhood of Geneva, Switzerland, during the years 1914 to 1918, I often happened to meet with particularly interesting Flagellata, and sometimes interrupted my ordinary work to study some of these organisms. The results of these investigations appear of sufficient interest for publication, and it is a particular pleasure for me to make them known here. The species to be discussed are: *Pteridomonas scherffeli* Lemm., *Dimorpha tetramastix* sp. n., *Dimorpha monomastix* sp. n., *Bicoeca exilis* sp. n., *Histiona campanula* sp. n., *Salpingoeca polygonatum* sp. n., *Salpingoeca lepidula* sp. n., *Chrysamoeba radians* Klebs, *Chrysopyxis bipes* Stein, *Hyalobryon ramosum* Lauterborn, *Cryptomonas ovata* Ehrenberg, *Astasia mobilis* (Rehberg) Alexieeff, *Euglena pseudomermis* sp. n., *Trentonia flagellata* Stokes.

***Pteridomonas scherffeli* Lemm** Plate V, figs. 1-3.

Though the description of the genus *Pteridomonas* dates back as far as 1890 (Penard, 28), the first concise diagnosis which we possess is due to Lemmermann (24), and I can do no better than to reproduce it here, at least in its most important points:

Pteridomonas Petard. Cells naked, mostly stalked; 1 flagellum, and rarely, besides, 2 slowly vibrating accessory flagella. At the base of the flagellum, a crown of fine radiating pseudopodia. One or two contractile vacuoles. Nucleus with distinct caryosom. Multiplication unknown. Food taken by the pseudomopodia, or by means of special food-vacuoles. Movement freely rotating, swinging, or by sudden leaps backward, due to the contraction of the stalk.

As for *Pteridomonas scherffeli*, which was found by Scherffel in Hungary, then by Lemmermann at Bremen, Germany, its specific characters are indicated as follows: "Cells generally longer than broad, in optical longitudinal section rounded with 5-6 angles. Stalk long and fine. Nucleus near the base of the flagellum. Besides the anterior crown of pseudopodia, some lateral radiating pseudopodia."

This *Pteridomonas scherffeli* was found in great quantities in the month of September last (1918), among the decaying leaves that filled the bottom of a pond, at the Ariana Park, near Geneva.

I was then enabled to study this very interesting organism at some length, and should like to discuss here some of the most important points of its structure.

Regarding the identity of my specimens: Lemmermann speaks of "cells longer than broad, in optical longitudinal section rounded with 5-6 angles," while in the Ariana specimens the breadth of the body was normally at least equal, and very often superior, to the length; and at the same time the anterior part was broader than the posterior (Plate V, fig. 1); in optical longitudinal section the form, rather than "rounded with 5-6 angles," was that of a top with a truncated point. In short, this Ariana form was but in a very general manner in accordance with Lemmermann's description; but as this very small organism is difficult to study, and is perhaps subject to great variation in its shape, it seems best at present to consider the two forms as representing the same organism.

Pteridomonas in form, as we just said, is more or less that of a top; the size is about 8-9 μ , often rather less, and rarely more. In the anterior part of the body we find, right and left, two small contractile vesicles, and also, in the posterior part, two other vacuoles, but of a special nature; the body, in fact, seems to be hollowed out to form two small depressions, one at the left and the other at the right, with a clear space or vacuole in the center; they hardly look like contractile vesicles, especially since these depressions are sometimes wanting, yet sometimes I have seen the vacuoles suddenly collapsing, as contractile vesicles generally do. The flagellum, whose length is equal to three or four times that of the body, is relatively strong, and easily seen. From the middle of the anterior part of the body, which is itself somewhat flattened or even excavated, this flagellum points directly upwards during the first part of its course, then curves right or left, and when vibrating becomes hardly visible. At its point of fixation it is provided with a basal granule, very small and mostly quite invisible, but which I could detect once on a gradually and strongly compressed specimen.

In Lemmermann's diagnosis we noted the following lines: "One flagellum, and rarely besides, two slowly vibrating accessory flagella. At the base of the flagellum, a crown of fine radiating pseudopodia." We must treat at some length of these rather important organs.

The central flagellum is normally surrounded by a crown of very fine threads, perhaps about one dozen in number, quite rigid and motionless, which point straight into the surrounding liquid, at an angle of about 45° from the central flagellum. These threads, which have generally been described as pseudopodia, and indeed

certainly appear to be such; very often seem to start, not from a middle region quite near the flagellum, but further away from the middle, even from near the extreme border of the body, like an anterior crown above the equatorial girdle of setae which we shall soon speak of. But it only appears so, and in fact one can easily see, on specimens favorably oriented for such observations, that all the threads of the crown have their origin in the immediate vicinity of the central flagellum. Sometimes, left and right of the flagellum are seen two much smaller flagella, slowly undulating, and quite independent from the big central one. These two small accessory flagella, whose meaning has not yet been understood, seem to have been a great puzzle for those few observers who noticed them; but more protracted observations, with adequate material, would have allowed of more certain conclusions. In fact, there are not always two accessory flagella, but sometimes one or two, or more; or, on a specimen where none was at first detected, suddenly there may be seen to appear a crown of small flagella, which begin vibrating, and after a very short time slowly retract, getting thicker the more they shorten—as if an axial thread were retracting into the body while the enveloping protoplasm accumulated outside—and finally collapsing each of them into a small roundish pearl. But after a time, each of these little pearls rapidly lengthens again into a long, fine thread, that becomes mixed among the other threads or “pseudopodia” which had remained expanded and rigid.

These observations, which have been repeated several times, seem to justify the following statement: The threads which compose the anterior crown are not pseudopodia, but flagella, which are capable of changing rapidly in their appearance and function; straight and rigid as a rule, they may for a time appear as flagella, with slow, flexuous undulations. However, these accessory flagella widely differ in their nature from the central one, which is a true flagellum. They are also completely independent from each other, one of them, for instance, is seen to vibrate while its next neighbor remains stiff; or some developing into a vibrating crown of flagella, while others persist in the shape of a rigid external crown of pseudopodia (Plate V, fig. 2).

As to the function of these special elements, for which we might use the term “flagellopodia,” in their rigid, pseudopodian state, they must be considered as prehensile organs, stopping on their way very small organisms or food particles and bringing them towards the body; on two different occasions, for instance, I have seen a small green particle caught by one of the rigid filaments, and the thread curving over it, then slowly retracting and finally depositing it on the surface of the body. This process is, however, not the

only one possible, and much more frequently the small food particle, without coming into contact with the extended threads, directly gets to the surface of the body, where a big vacuole is immediately formed around it; but it remains certain that these rigid filaments, twice or three times as long as the body, form together something like a net, and as such are of very evident importance. But besides these functions as prehensile organs, such as are observed in the pseudopodial state, could not we imagine functions of a different nature, due to the flagelliform state of these particular threads? When describing for the first time, in 1890, the genus *Pteridomonas*, I felt confident I had seen the small pearls at the base of the central flagellum suddenly unroll and fling the little animal backward; the flagellopodia, in fact, were to be compared to the frond of a fern and not to a compact shapeless body. But Scherffel, in 1901, proposed another explanation; —he looks upon the threads as true pseudopodia, quite incapable of passing into another condition; the two smaller flagella, which are at times seen left and right of the central flagellum, “are in no way two pseudopodia which have taken to an undulating condition, as Penard thinks. Their function is unknown”; and a little further on he adds: “The jumps are due to the energetic and sudden contractions of the fixed stalk.” Much later, in 1904, after observing some specimens of *Pteridomonas* from the Lake of Geneva, I had myself abandoned my former explanation to adopt the Scherffel theory, and today, after a much more thorough examination, I feel confident the rolling and unrolling explanation was a mistake; but is the sudden jerk backward due really to a contraction of the pedicle?

In *Pteridomonas*, the body is protracted behind into a thread, of extraordinary thinness, like the thread of a spider; and this thread or pedicle, four, six, or as much as eight times as long as the body, firmly holds the animalcule to the substratum. In such an attached condition, the little organism is generally seen fishing, with its central flagellum actively swinging, and the threads of the anterior crown rigid, unmoved, and expanded at their full length, but from time to time the animalcule suddenly disappears from sight, and rapidly comes back, a jerk has thrown him to one side but the fixed pedicle prevented any definitive removal. This posterior thread is thus very important in enabling, for instance, the animalcule to escape the contact of an enemy and yet remain in the same region; but it is hardly to be expected that the pedicle might do more than attach the body, and be comparable to the

retractile pedicle of a *Vorticella*. Its whole appearance is that of a very thin, thread-like secretion, where no structure is to be found; and indeed, facts may be cited which go against the retractile explanation:

Looking at a fixed *Pteridomonas* for a sufficient time, a moment at last comes when the pedicle suddenly loses its hold, the crown of pseudopodia retracts, and the little animal swims rapidly away, while the detached posterior thread or pedicle trails behind. In such a state of rapid locomotion, with pedicle trailing or sometimes with no pedicle at all (owing to its having been ruptured or having collapsed), when coming into contact with some Infusorian or any other obstacle in its way, the animalcule may suddenly jerk backward, just as it did when attached.

Under these conditions it seems hardly possible that the stalk might be the cause of the sudden jerk; and we must look for another explanation.

The most evident distinctive character between *Pter. scherffeli* and *Pter. pulex* is the possession, by the first of these species, of lateral filiform appendages, which are wanting in the second. Lemmermann speaks of these appendages as follows: "Besides the anterior crown of pseudopodia, lateral radiating pseudopodia are found." Neither Scherffel nor Lemmermann speak of these "pseudopodia" as being regularly distributed, and the first of these observers speaks of both anterior crown and lateral appendages in the following terms: "The fine setose cilia, which radiate mostly from the anterior part of the body, around the flagellum, *but sometimes also start, in a smaller number, from the sides of the body*, are true pseudopodia." Both these authors, in fact, seem to consider these lateral appendages as identical with those of the anterior crown, and at the same time as irregularly located on the sides of the body. But the reality is, that these particular threads, six in number (or perhaps eight ?), are inserted in a single equatorial line, or girdle, which itself is, in most of the individuals, indicated by a slight groove that divides the body into two parts, superior and inferior. These threads are extraordinarily thin, are straight and rigid, and are twice or even three times as long as the body; they never are converted into flagella, and never retract into separate pearls, and are in no way comparable to the constituent parts of the anterior crown—they rather seem to be identical with those setae with which some Infusoria (*e. g.*, *Mesodinium pulex*) are provided. Now in these Infusoria the setae always work as a

jumping organ; and why should their function not be the same in *Pteridomonas*? There is a fact, indeed, which seems to contradict such a theory,—*Pteridomonas pulex*, which has no such setae, jumps just as well as *Pt. scherffeli* which possesses setae, but . . . it is not quite certain that *Pter. pulex* is unprovided with setae. None have been seen, it is true, but they are so extremely indistinct, in *Pter. scherffeli*, that during the first days of my observations I had no idea it was not *Pter. pulex* I had to do with, and only later on the mistake was found.¹

It is, then, to that aequatorial girdle of setae that I should be disposed today to attribute the jerks of *Pteridomonas*, but the question yet remains in doubt.

When speaking of the anterior crown, we saw that each of its "flagellopodia" is liable to collapse into a small globular body, and that all of these small pearls constitute then a sessile ring around the central flagellum. Now it is rather interesting to notice that this very sort of ring sometimes is found also at the posterior extremity (Plate V, fig. 1). In that particular locality, the Ariana Park, which furnished practically all my material, this posterior crown existed in one out of five individuals, being sometimes well developed, more often more or less reduced in the number of the "pearls", but none of these pearls ever could be seen to develop into a thread; they were always in the retracted state, and very likely were unable to change in any way.

As to the meaning of that posterior crown of pearls, at first sight it seems that it would indicate the anterior part of a new individual, to be formed by an act of division which must then prove transverse. In spite of the fact that a transverse division would be very exceptional in a Flagellate, I was inclined to consider it as very probable here, till meeting one particular specimen which certainly was dividing (Plate V, fig. 3). It was much broader than long, with two flagella, a nucleus elongated transversally to the vertical axis of the body, and two posterior threads, each with some pearls around its base. This specimen showed the beginning of a *longitudinal* division. We must then conclude that the meaning of the posterior crown is not yet understood.

¹ The first description of *Pter. pulex* is dated 1890. At that time I had at my disposal only a small, student's microscope, and practically the aequatorial setae must have been invisible. Besides, *Pter. pulex* hardly ever seems to have been studied afterwards. Scherffel and Lemmermann had *Pter. scherffeli* under observation, and though some other observers cite *Pter. pulex*, I do not know of any who studied it.

Such are the observations which I could make on *Pteridomonas*, a very small and delicate organism, but one whose structure proves very particularly interesting; and in my opinion the principal interest attaches to the special threads or "flagellopodia," whose functions are double, now pseudopodia, now flagella. Scherffellie, 1911, whilst treating of *Chrysopyxis bipes* and its pseudopodia, observes that the existence of food-capturing flagella has never been proved in any of the Protozoa; but in *Pteridomonas* we find something quite exceptional: the food is caught by pseudopodia, the undulating movements are due to flagella, but these very flagella were pseudopodia some minutes before, and next moment will be so again.

***Dimorpha tetramastix* sp. n.** Plate V, figs. 4-6.

"Cells with distinct periplast, free-swimming. Pseudopodia numerous, with axial threads that radiate from a central granule situated inside the body. Two flagella, originating in the neighborhood of the central granule. Nuculus with distinct caryosome. One to several contractile vesicles. . . ."

Such is the diagnosis given by Lemmermann (in Pascher's "Süsswasser-Flora," p. 51) of the genus *Dimorpha*, which Gruber (14) created in 1881 for a small Protozoan whose characters are at the same time those of a Heliozoon and a Flagellate.

Dimorpha mutans is the only species that has been described; however, one other has been at least indicated. Blochmann (3), in 1894, after treating of *Dimorpha mutans*, concludes in the following terms: "I myself found, in the summer of 1885 in a pond of the Schwetzinger Garden, another form, of which I unhappily took only a few incomplete sketches. It differed from *D. mutans* in the possession of four flagella, and also in the fact that it always swam about with fully expanded pseudopodia."

In the month of July last, and later in August and September, I found in the same pond of the Ariana Park a species of *Dimorpha* provided with four flagella. Is it the same as that mentioned by Blochmann? Possibly so, but, as we shall see later, it is not certain. Is it even a *Dimorpha*? According to the first diagnosis of the genus, which mentions two flagella, it is not; but, like Blochmann, I should rather insist on the fact of the resemblance with an Heliozoon than on the possession of one, two or more flagella.

Dimorpha is indeed now a Heliozoon, and now a Flagellate. Let us first consider our *Dim. tetramastix* in the Heliozoon, that is, in the resting state (Plate V, fig. 4):

The spherical body, 30 to 33 μ in diameter (much larger than *Dim. mutans*) is naked, but not smooth, owing to the presence of numerous granules of a relatively large size, some of which project a little outside the surface. Two layers, in fact, may be distinguished in the plasma, the ectoplasm with the above-mentioned granular bodies, and the clearer endoplasm; but the difference between the two layers is here much less distinct than in typical Heliozoa, those for instance which constitute the group of the Chalarothoraca. Around the body, and radiating in every direction, but less numerous anteriorly, are the pseudopodia, straight and very fine, whose length attains to 1½ to 2 times the diameter of the body. Just as in Heliozoa, they are covered with small granulations, but are even smaller here; and besides, they have sometimes a peculiar appearance, which does not seem to have been observed in Heliozoa as a rule: as long as they have not attained to their entire development, their tip is blunt, truncated at a right angle to the longitudinal axis; but when fully extended, they are pointed; one might suppose that in the first case the layer of viscous plasma which covers the axial thread did not extend further than the axial thread itself, and in the second case it had gone farther, lengthening to a point. Axial filaments exist here indeed, as in typical Heliozoa, and in favorable conditions they may be seen to penetrate the plasma and converge towards a central granule, which itself is easily distinguishable, and with carmine stains quickly. But this "central granule" is in fact never quite central but lies at a greater or less distance from the center toward the anterior extremity.

This central granule is itself surrounded by the special apparatus which Gruber (14), Blochmann (3), Schouteden (31) have already described in *Dimorpha mutans*, but which is here of a rather different nature, consisting of very small, yellow, spherical grains, which are set around the central granule like numerous radiating chaplets, owing, very likely, to their being attached to the axial filaments which converge towards the centre. All together, they build up a kind of spherical cage, quite characteristic of *Dimorpha tetramastix* and allowing one easily to distinguish this species from any Heliozoon in the vicinity.

Food is caught by the pseudopodia, and in a very characteristic manner. On four or five different occasions I observed the capture, and always it was the same small Infusorian, *Balanitozoon agile*, which suddenly came into contact with one or several of the pseudopodia; these then tightened around their captive, and at the same time a very thin film or velum came creeping over the pseudopodia, lengthened into a cup, and finally closed behind the Infusorian. This latter, which had been suddenly killed as by some special poison, became more and more elongated, then was cut into

two parts, the first of which entered the body of the *Dimorpha*; the second fragment then divided again, and finally each of the separated portions got into the *Dimorpha* and quickly rounded itself into a small pellet. Our *Dimorpha* seemed in fact to feed exclusively on this little Infusorian, and proved excessively gluttonous. Three minutes are sufficient for the conversion of a living *Balanitozoon* into a number of pellets inside the *Dimorpha*, and this latter, which measured at first say about 30μ in diameter, increases to 40μ in diameter after the capture.

We must now consider the flagella somewhat at length. In a *Dimorpha* favorably oriented for good observation, one can distinguish in the body an anterior part, slightly flattened, and even sometimes depressed to form a shallow median cup, and from that cup arise four very fine threads, hardly visible, about twice the length of the body; they appear and suddenly disappear, and when lost are very difficult to trace again, owing to their extraordinary tenuity. Two of them are often seen to cross each other at a short distance from their base, which fact is due to their being in pairs, one of the pairs originating left and the other right of a central point of fixation (Plate V, fig. 4).

Gruber could not ascertain the presence of a nucleus, at least in the living animalcule, but says he easily demonstrated it with reagents. Blochmann, however, and afterwards Schouteden (31), each gave a rather complete description of what they consider as the nuclear apparatus, and it is interesting to quote what the latter of these observers writes upon the subject: "The nucleus is already visible in the living animal, more or less distinctly according to the individuals. But it is easy to make it appear by killing the organism with a solution of picric acid, which colors the nucleus yellow. One sees then that chromatin is united in a thick mass which in optical section appears like a crescent with more or less rounded or obtuse points; really this mass constitutes something like a hemisphere (or segment of a sphere, smaller or sometimes larger,) hollow but with a thick wall.

"Inside that peculiar mass, in the cavity which it surrounds, one sees the axial threads of the pseudopodia, which pass through the body, to converge toward the same point, namely to a shining, very distinct granule, which is indeed already visible, with some attention, in the living animal. In this same place, besides, is the insertion of the flagella, which diverge from the common point inside the plasma and come out of the body in two distinctly separated regions . . . Blochmann was rather puzzled by the fact that the axial threads of the pseudopodia thus converge *through the nucleus*

toward a common point. He does not think probable that there could be there a continuous axis which would pierce through the nuclear substance. And yet, according to my observations, the complicated apparatus of *Dimorpha* must indeed be thus explained. The axial threads which are seen converging run completely through the chromatic mass, pierce it in fact, and nevertheless they are absolutely continuous and homogeneous."

These observations are interesting, in so far as they show the flagella to be inserted quite near the central granule; but both Blochmann and Schouteden are certainly wrong when they consider as a nucleus that particular apparatus which we have seen in *Dimorpha tetramastix* consists in radiating lines of pearls. In reality, the true nucleus, generally concealed by the accumulation of granules and food-particles, easily comes to view by means of a slight compression of the animal. It quite conforms in character to an ordinary Heliozoan nucleus, being rather large, homogeneous, variable in its shape, and always somewhat excentric in position.² There are several contractile vesicles, variable in number, but so obscured by the mass of granules and food-particles that fill the external layers of the body, that one hardly sees them.

Such is the Heliozoan form of *Dimorpha tetramastix*; but if we keep the animalcule under observation for a while, after five, ten, twenty minutes or more, we can see its transformation into the flagellate state. Suddenly, and without any apparent motive, the pseudopodia are seen to retract, at the same time as the body lengthens, and the central granule with the surrounding chaplets of pearls moves forward; and after a single second of time, or at most two, the Heliozoan has disappeared, and instead we have a true Flagellate (Plate V, fig. 5), more or less lengthened, with an anterior depression from which arise the two pairs of flagella. Something, however, is frequently left of the pseudopodia, in the form of lateral or, more often, posterior appendages, more or less covered with granules (Plate V, fig. 6); and some of the axial threads are still visible, trailing inside the body, behind the central granule which is now quite near the anterior extremity.

It is possible only under particularly favorable conditions to get a clear view of the phenomenon of the mechanism of that sudden transformation, but I was able to observe it several times and

² Blochmann, in his figure of *D. mutans* in the Heliozoan state, has in fact represented the nucleus, but as a "particle of food."

with sufficient clearness to be able to explain the facts. The pseudopodia, at the same time that they retract and shorten, move backward while the central granule is brought forward; this displacement of the pseudopodia is, in fact, to be compared to the shutting of an umbrella, whose ribs are brought down and collapse together. As for the cause of the shutting, it must very likely be sought in internal movements inside the plasma, which result in an accumulation of clear pure ectoplasm at the anterior extremity; if we can imagine a current coming from behind and pushing the central granule forward along the longitudinal axis of the body, and at the same time lateral backward currents pushing the axial rods downward, we can get an idea of the transformation.

As it is, the Flagellate, which now measures about 37μ in length, *i. e.*, 7μ more than in the Heliozoan shape, immediately takes to swimming, rapidly drawn forward by its flagella. As already noted, some of the pseudopodia, or rather some of the axial threads with their covering of granulations, are very often seen trailing laterally or behind, but I never could see, as Blochmann said of his unidentified *Dimorpha*, the animalcule swimming with completely and normally expanded pseudopodia.

Swimming never lasts very long; the most trifling cause is sufficient to instigate reversion to the Heliozoan type; the animalcule is seen to stop, and suddenly the pseudopodia make their appearance, lengthening at the same time as they are brought forward, while the central granule moves downward toward the center of the body. The same kind of phenomenon has taken place, which we compared to the shutting of an umbrella, but it is now the opening, and it has been even more rapid.³ This transformation from the Flagellate state to the Heliozoan type is brought about by anything that might be supposed to indicate trouble or danger—a small Infusorian in the vicinity, a current of water, etc.—while the inverse, the transformation from the Heliozoan into a Flagellate, is much more difficult to produce; a strong light, however, which provokes the displacement of the animalcule toward a cooler region, is often successful. Very probably, the Heliozoan form is the form of defense, the pseudopodia firmly affixing the body to resist currents, and at the same time it is the fishing-form, allowing small organisms to be caught by the pseudopodia.

³ This reversion is still more shortened by the action of a chemical reagent; in one particular case, for instance, I have seen the transformation entirely effected in the half of a second, under the influence of a very weak current of glycerin and carmine.

Must we consider *Dimorpha* as a Heliozoon or as a Flagellate? As a Flagellate, of course, since it is an understood fact that all organisms are to be considered as such, which possess flagella in the adult state; but the affinities with Heliozoa are so great that, in fact, we might look upon this organism as a Heliozoon also. In some of the representatives of this latter group, for instance, *Clathrulina*, an embryonic stage is known, where the little being is in possession of flagella; and one might be entitled to ask if *Dimorpha* could not be a member of the same group, in which the flagella persist up to the adult state?

In this connection I should like to relate a rather curious coincidence: in the same locality there was living, in still much greater abundance, a genuine Heliozoon, of a yet undetermined type, and whose likeness to *Dimorpha tetramastix* was such that only the possession of the characteristic pearl apparatus and the non-existence of a flagellated state allowed an easy distinction. At the same time, there were occasions when I never could detect any trace of flagella in otherwise typical Dimorphas, and sometimes also the pearl apparatus was hardly to be seen. *Dimorpha* might be supposed to lose finally its flagella, as well as the pearl apparatus which in some unknown way might be in relation with them? But, leaving that supposition aside, what more beautiful example of mimicry could we imagine?

***Dimorpha monomastix* sp. n.** Plate V, figs. 7, 8.

The preceding species was characterized by the presence of four flagella; now we find only one. *Dimorpha monomastix* was found in the same locality, and in a much greater abundance, but its small size makes it rather more difficult to study.

The little organism is about 10 μ in diameter, transparent and colorless; in a superficial region are seen dispersed all sorts of granules and food-particles, surrounding an indistinctly delimited clearer central region or endoplasm, which contains the nucleus. This latter is spherical, with a distinct nuclear membrane and a large central caryosome. Very likely this endoplasmic region also contains a central granule, which, however, I did not see. There are several contractile vesicles, all very small, except one that might be considered as the principal one, the others being accessory. All around the body are the pseudopodia, of the typical Heliozoan type, but relatively short, measuring about 1½ times the diameter of the body. The flagellum, always single, is of a moderate length also, about the same as that of the pseudopodia, but strong and thick, much thicker, in fact, than in *Dimorpha tetramastix*. How-

ever, it is extremely transparent, and there is some difficulty in distinguishing it; a moderate enlargement, indeed, which allows of a very small diaphragm, is better for its detection than very strong magnification.

During the Heliozoan state of rest, the flagellum remains quiet, and nearly always with a peculiar shape, somewhat like a figure 8 (Plate V, fig. 7); from time to time, however, it is seen slowly to unroll, and to perform one or two slight movements, soon coming at rest again.

This Heliozoan type is the less frequent form, and the animalcule never keeps it for a very long time. After a few minutes of observation, the swinging of the flagellum grows quicker and more frequent, and suddenly the whole body seems to be subjected to a disturbance, a rupture of its internal equilibrium. It collapses, in fact, and one might take it to be disorganized and dead; but after hardly one or two seconds have passed, the whole mass, as by enchantment, lengthens into a fusiform body, having anteriorly a quickly-moving flagellum.

The little flagellated being (Plate V, fig. 8), which from 10μ in the Heliozoan state has now increased to 18μ in length, and even sometimes more, has the appearance of a fish, broader at the anterior part, and drawn posteriorly into an often very thin and long extremity, which seems to result from the fact that the axial threads have joined together and trail behind. The nucleus, very distinct, has come forward, very near the anterior extremity, and is seen surrounded by very small, hyaline granulations. The flagellum comes straight from a slight excavation in the middle of the anterior, rounded extremity. Several small contractile vesicles are visible, one of them larger, near the posterior end of the body.

The animalcule goes straight forward in a rapid course and swims for a very long time, for hours probably; then suddenly it stops, the flagellum becomes quiet and takes the characteristic figure 8 shape; again a commotion, which shakes the whole body, and rays are seen to protrude from every part of the surface. In two seconds, the Flagellate has turned into a Heliozoon.

The transformation is effected here in the same way as we saw it in *Dimorpha tetramastix*, but is much less evident to the eye.

Bicoeca exilis sp. n. Plate V, figs. 9-13.

This elegant little Flagellate was found, in February, 1918, rather abundant in one of the aquaria of the Zoological Laboratory of

the University. Most generally it was attached to the threads of a small *Nostoc*, either solitary or with one or two companions, but never in big colonies.

The little capsule (Plate V, fig. 9), very thin and colorless, is 8μ in length; ovoid or somewhat fusiform in shape, pointed behind and opened anteriorly in a large aperture, at right angle to the longitudinal axis. This opening, however, is rather variable in breadth, according not only to the individuals, but also to the orientation of the animal; the capsule, in fact, is a little compressed, more so at the opening than anywhere else, and at the same time proves somewhat elastic; when the animalcule protrudes for half its length out of the shell, it presses against the sides and makes the opening rounder, and when suddenly retracting the edges of the aperture contract. The capsule is affixed to the substratum by means of a very thin pedicle, a simple colorless filament, whose length is exceedingly variable, and is commonly twice or three times as great as that of the capsule, sometimes even more. Frequently it is seen to terminate at the point of fixation in a small bluish knob or cushion, and from the fact that the volume of the knob is in inverse proportion to the length of the pedicle, one can infer that it furnishes the material for the lengthening of this thread. This growth of the pedicle, however, must be very quick, and reaches its limit a very few moments after the fixation of the animalcule; such is, at any rate, the inference that might be drawn from the fact that specimens with very short stalks (Plate V, figs. 9, 12), kept under observation for ten, twelve and twenty-four hours, never showed during that time any lengthening of their stems. Very likely the length of the pedicle is in some relation with the conditions of the medium; for instance, in some material which had been kept a long time since it was collected, I once found all the individuals short-stalked (Plate V, fig. 12). The animalcule hardly fills half of the capsule. In its perfectly expanded state, it is pear-shaped. At the anterior extremity and on one side is seen projecting a protoplasmic appendage which looks at first sight like a very short pseudopodium; but in reality the ectoplasmic layer developed here in a collar-like expansion, hardly conspicuous on one side but very extended on the other, and whose function is to hold fast the small particles of food that the flagellum has thrown down. The flagellum, which starts from the anterior depression, is strong and very distinct, and of very remarkable length, attaining five or even six times the length of the body. When the animalcule is quietly fishing, with its body half protruded from the shell (Plate V, fig. 9), the flagellum is seen pointing directly upwards, and hardly seems to move, but sometimes is only distinguishable up to the half of its length, the tip only vibrating. The animalcule does not, as a rule, remain very long in the extended state; it suddenly retracts inside the shell and becomes ovoid in shape, but for a very short time only, soon expanding again. The behavior of the flagellum is then very interesting to follow: when the animalcule retracts, the flagellum coils

our *Bicoeca exilis*; but the special shape of the capsule, as also the very exceptional length of the flagellum, seem to point to a special organism, which has not yet been described.

Histiona campanula sp. n. Plate VI, figs. 14-19.

During the autumn of 1917, I found in a pond at Pinchat, a small Flagellate which seems to belong to *Histiona*, a genus itself very little known. It was most generally found fixed on the threads of a certain *Zygnema*, very often forming long colonies of individuals, standing next to each other along the mucilaginous sheath of the alga.

The protoplasmic body, very clear and delicate, occupies less than half of the capsule (Plate VI, fig. 14), which latter is itself so thin and transparent that its structure is not determined without some difficulty. It may be compared to an inverted bell, broadly open upwards, and whose closed end would be stretched on one side, so as to make a horn-like prolongation; and owing to this special form the little case, which rests with its posterior point just on the surface of the mucilaginous sheath, appears bent down like a small flower (*Campanula*) on its stalk, the concave side of the capsule being towards the *Zygnema* (Plate VI, fig. 14). The little capsule is at the same time laterally compressed, and seen from behind looks somewhat like a sugar-loaf (Plate VI, fig. 15). The capsule is provided with a pedicle, thin and colorless, which goes right through the jelly and joins the surface of the cellulose membrane of the *Zygnema*, where it is most generally seen to attach by means of a shining little cushion. The pedicle, we must observe, is not a true pedicle in fact, but is rather a protoplasmic thread more solidly affixing the cell to the substratum; the jelly alone would not allow of a sufficient hold; and, by the way, we must add that the mucilaginous layer being generally perfectly invisible, the capsule seems to be provided with a stalk; as for the length of this stalk, it is of course equal to the thickness of the mucilaginous layer, about 13 μ or sometimes a little more or less. The protoplasmic body, which appears as if suspended inside the capsule without anything to keep it in place, is also very individual in its appearance: rounded behind, cup-shaped anteriorly, it is drawn up on one of its borders (always the same, that which is in contact with the convex face of the shell) into a long trunk-like appendage, which passes beyond the capsule and protrudes into the surrounding liquid. From the tip of that peculiar appendage stretch right and left two thin and broad protoplasmic curtains, which, passing over the intervening space join at last the opposite border of the cell. In fact, these curtains, or veils, may be considered as representing the extreme borders of the cup-shaped body, which have grown very thin and transparent. One of these veils, moreover, is much more developed than the other, and about the middle of its course

is drawn up in an angular lobe, to be affixed there to the inside of the wall of the capsule, and this in a very curious way, by means of a "nail," a very small bluish spot, which is never wanting. Very likely this very fixation of one of these curtains to the border of the cell is a result of the necessity for the cup (or anterior part of the body) to remain open, for the veil, if it passed straight over to join the border at the opposite side, would prevent small food-particles falling into the cup.⁴ The flagella are perhaps more curious than any other element in this already somewhat paradoxal being. There are two: the first one, which we might call the principal flagellum, starts (or rather seems to start?) from one of the borders of the cup, which we may consider as the right one, and very soon bends to the left, describing thus the figure of an arc, and finally terminates freely somewhat to the left of that appendage which we called the trunk. This flagellum nearly always proves perfectly quiet, like a bow stretched over the cell as if for protection against the intrusion of any enemy. It is a genuine flagellum, however, and from time to time begins vibrating, but becomes quiet again after a moment. The second flagellum is perhaps even more curious: upon looking attentively at the left border of the cup, and more especially at the tip of the "trunk," we find there (Plate VI, fig. 16) two very small bluish granules, one behind the other, and from the upper granule is seen to start a rigid, straight thread, whose length nearly equals that of the body, the structure of the thread, which diminishes in breadth from the base to the summit, seems to be that of an axial filament covered with a thin layer of hyaline plasma. This thread immediately turns somewhat to the left, and there remains quiet, like a tactile organ or seta, from time to time, however, it is seen to move right or left, like the hand of a watch, or, very rarely, to swing in a few longitudinal undulations, but only to come quickly to rest again. Indeed it hardly looks, like a flagellum, but is such in fact, only it temporarily departs from its normal functions to acquire a new importance. If we look very attentively at the anterior small corpuscle of which we were just speaking, and not above but behind it, we can just distinguish a very fine median line or thread, which passes the posterior granule, then continues its way down towards the bottom of the cup-shaped body.

In short, *Histiona campanula* is in possession of two flagella, but both seem to have been considerably modified in either structure or function.⁵

⁴ I never could see the second of these two "curtains" affixed to the capsule, and this second curtain is in fact so much smaller than the first that it might be considered simply the normal border of the cup.

⁵ These statements about the flagella are the result of a good many observations, but the animalcule is exceedingly small and delicate, and more than one doubt is left in my mind about some points of its structure. I have seen, for instance, on two different occasions a very short flagellum beating at the floor of the cup; was it a normal structure, or perhaps the basal part of the right flagellum, torn off from the affixing blue granule?

It is not likely that these modified elements should be considered as the principal agents in the capture of food. Rather must we think that the large surface displayed by the cup with its velum-like borders has the function of a net; I have very often observed small nutritive particles to be thrown, or rather to get caught on the surface of the expanded cup; and suddenly, when it hardly touches the net, a vacuole is formed, inside which the microbe (most frequently microbes were the normal food) violently struggles for a time, then suddenly collapses, as if killed by some poisonous substance. The food-vacuole then glides along the velum and finally disappears inside the body.

The nucleus, spherical and with a big central caryosome, is very distinctly seen, in the hind-part of the body. There is only one contractile vesicle, not far from the nucleus; some other vacuoles, however, are at times visible, either containing food-particles or not.

Phenomena were not observed concerning the division of the body, but I have frequently met with individuals in the naked state, which either resulted from an act of division, or, in a majority of the cases at least, had left their envelope to take to a swimming existence. Their appearance is quite characteristic (Plate VI, figs. 17, 18), nearly that of a mandolin, whose handle would be represented by that peculiar "trunk" we have spoken of; but then, from this very extremity where the small blue granule is still to be seen, starts now, not a rigid thread, but a true flagellum, which, beating normally, draws the animalcule forward in a rapid course; the functions, indeed, of the thread have changed, and have become those of a normal flagellum.

As for the other flagellum, which we looked on formerly as the principal one, it is now seen to start from the posterior, slightly pointed extremity of the body, and immediately curves upward, describing an arc whose tip becomes lost behind the body, near the base of the trunk; this bow-like curvature seems at first sight to delineate the very contour of the body (Plate VI, fig. 17), which fact gives the little being a very peculiar appearance.

After swimming for a time, the little Flagellate comes to rest; it sets itself down on the surface of a *Zygnema*-thread, and firmly implants itself there by its posterior pointed extremity; and hardly is the contact effected when a small root begins piercing the jelly (Plate VI, fig. 19), growing longer and longer, till after a few minutes it reaches the solid wall.

I could not ascertain how the animalcule constructs the new envelope. It seems likely that the naked individual, when already fixed, can remain a very long time unprovided with any covering; I found once a colony where all the animalcules, about six in number, were naked, and three days afterwards, though living and apparently in good health, only one of them was provided with a capsule. It is interesting to note that the animalcule, as seen enclosed in the shell, does not occupy the same position as he did when free; the posterior point, from which arises the arcuated flagellum, must have become displaced upwards and to the right, at the same time that the body became free from the pedicle and climbed up towards the opening of the shell.

Salpingoeca polygonatum sp. n. Plate VI, figs. 20-28.

This small organism was found in the same locality as the last one, at Pinchat, on the long filaments of *Zygnema pectinatum*, and as a rule the threads were either abundantly provided with the little Flagellate, or had none at all.

The capsule (Plate VI, fig. 20-28) is about 17μ in length with a breadth of $4\frac{1}{2}$ to 5μ only; it is nearly cylindrical for most of its length, but is somewhat broadened at the aperture, and is rather abruptly narrower behind,⁶ terminating in a point which itself rests on a thin, very short stalk; but note that, as in *Histiona campanula*, the stalk is not a true pedicle, rather a root, which pierces the mucilaginous sheath of the *Zygnema* and becomes attached to the cellulose wall below. It may be observed at the same time that *Histiona* and *Salpingoeca* chose two different *Zygnemas* as a substratum, and that in the former of those animalcules the jelly coating was thicker than in the second; hence the longer stalk in *Histiona*. The protoplasmic body (Plate VI, fig. 20), cylindrical in shape, and about 10μ in length, looks as if hanging down inside the cell, its upper end reaching as far as the aperture, while the lower, rounded end is at some distance from the bottom. It remains entirely quiescent, as a rule, but from time to time the little organism shakes weakly from head to foot, or suddenly retracts to the very bottom of the shell. The nucleus, spherical with a big central caryosome, is in the anterior part of the body, normally between two layers of very small hyaline granules. The contractile vesicle, rather large, has its place in the posterior portion of the body. When the animalcule is seen somewhat retracted in the shell, but still with its cylindrical shape, it proves to be deprived temporarily of that special protoplasmic collar which is known

⁶ The form is nearly that of the flower in the genus *Polygonatum*, hence the specific name.

in Craspedomonads, but instead, there is a thick layer of delicate purely ectoplasmic substance, which constitutes, in fact, the material for the building up of the collar. After a moment's observation, one notices the protoplasmic layer growing upwards, becoming cup-shaped and more and more lengthened, and at last it has grown into a funnel, whose length nearly equals that of the animalcule itself, but it is so thin and delicate that only the two borders, right and left, can be seen, and as for the anterior rim it remains (as in most of the Craspedomonadina) entirely invisible.

In *Salpingoeca polygonatum*, as well as in several other representatives of the group, one might easily believe in the presence of two concentric protoplasmic collars; but it would be a mistake, and I can only agree with the conclusions of Lemmermann (24: p. 564) relative to *Diplosigopsis frequentissima*: "As there is, in fact, in that species but one plasmatic collar, it must pass to the genus *Salpingoeca*." But when the same observer continues: "How it is with the other Craspedomonads where two plasmatic collars have been mentioned, remains to be investigated," I should go further yet and should not be astonished if both the genera *Diplosiga* and *Diplosigopsis* had to be abandoned.

The flagellum, about $1\frac{1}{2}$ times as long as the animalcule, is rather thick and distinct, and points straight upward, swinging with longitudinal undulations that sometimes affect the whole length of the flagellum, and at other times only concern the tip.

I very often had the opportunity to observe the reproductive phenomena, which are very interesting here. In Craspedomonads, transverse division, quite an exceptional fact among Flagellata, has been several times mentioned, and S. Kent, for instance, figures it in *Salpingoeca gracilis*, on Plate VI of his great classical work. Within the capsule are seen the two products of the division, still united to each other by a very thin tubular film, which soon will cut in the middle and form the two new collars. My own observations quite confirm the facts; first the body retracts, then loses its shape and appears an ovoid mass, and finally this mass becomes transversally sectioned; the upper of the two animalcules thus formed then rapidly rises towards the aperture of the shell, drawing out at the same time an axial, varicose filament or future flagellum, which gets thinner and thinner, and forming also around the circumference a thin tubular protoplasmic film, which unites the two new individuals (Plate VI, fig. 21). Each of these then lengthens, and the upper one becomes somewhat curved, leans with its concave side against the border of the capsule, and disengages its fla-

gellum (either by a simple cutting, or perhaps, as it sometimes seemed to be, by separation of two flagella, which existed before but were glued together); at the same moment, the plasmatic tube divides and soon retracts on each of the new individuals. As soon as the separation is achieved, the upper individual oscillates on the rim of the shell, turns slowly down, and its flagellum is then seen pointing forwards. The little organism contracts somewhat, and remains quiet for some time, then suddenly darts forward, carrying in front of it a very long flagellum, longer, it seems, that it will be afterwards (Plate VI, fig. 22). It swims very rapidly, describing large circles, then suddenly stops, rests for a time, starts and swims again, rests, and so on for probably a long time, but I could not determine the period. The length of the animalcule is 7μ . One sees easily the anteriorly placed nucleus, and behind a large contractile vesicle, sometimes with an accessory one; a short protoplasmic collar is also present. The entire process, from the moment when both individuals are distinctly separated but yet quite near each other, to the darting away of the little flagellated animalcule, has lasted but six or seven minutes. As for the lower individual, which remained in the cell, it expanded in a few minutes also.

But things are often quite different: the young animalcule, which has just disengaged from the cell, instead of darting forward, remains quiet for a time, as if hesitating, then, with a few very weak downward beatings of the flagellum, slips along the exterior wall of the shell it has just left, and soon settles quite near, lying along the mucilaginous covering of the *Zygnema* (Plate VI, fig. 24, *a*). However, it very soon stands up straight on the jelly (Plate VI, fig. 24, *b*), and ten minutes after the first contact with the substratum it is already seen to have produced a very short root (*c*), which soon will reach the cellulose wall (*d*, *e*, *f*). But during that time also, the first rudiments of the new envelope are deposited, a thin film around the body, along which the animalcule soon rises, leaving the empty posterior end of the capsule behind. In fig. 23, which is an enlargement of *f* in fig. 24, the body is seen to swell out laterally, so as to press everywhere on the anterior part of the cell and enlarge it, somewhat like a potter who moulds his clay, but instead of a finger, the whole body is here employed. A little later (Plate VI, fig. 24, *g*), the body has retracted a little, the widened borders of the capsule are free, and are even too much expanded but will soon contract a little. The animalcule, however, moves more and more upward, and finally shapes up the aperture of the

cell, very likely in the same manner as will be described in the next species; but I could not follow the events to the end, owing to the animalcule being lost by accident.

But such a division into equal parts is not the only one that can be observed. I happened twice to meet with quite another process. Instead of an equal transverse division of the individual, a very small portion only was seen to detach; first a little bud (Plate VI, fig. 25, *a*) at the anterior end of the body, then (Plate VI, fig. 25, *b*), after complete separation, a spherical little being was formed, hardly 5μ in diameter, with a long flagellum and a normal contractile vesicle; then it lengthened into a little flagellate, whose small size was the only character to distinguish it from the normal individuals. I could not, however, follow the little swimming organisms very far, and cannot suggest any explanation of the phenomena. Perhaps the cases were purely pathological.

Encystment was often observed.⁷ The body becomes a yellowish olivet green, then a golden yellow, and finally brown; a membrane has gradually been secreted, which grows finally very thick; at first it is transparent enough to allow of the contractile vesicle to be distinctly seen, but finally it looks quite opaque. A very curious fact which remains to be noted (Plate VI, fig. 26) is that up to the completion of the construction of the cyst, the anterior part is open, and from the opening are seen still protruding either the collar or both the collar and the flagellum. Only when the construction is entirely finished, these plasmatic appendages begin to retreat, disappearing in the cyst itself; this latter, then, is seen to be cylindrical, or somewhat swollen in the middle (Plate VI, fig. 27), and may be compared to a cannon shell, provided anteriorly with a circular opening, which also, however, will soon be shut. Old cysts, in fact, generally have no opening, yet sometimes an anterior aperture is visible, but in empty cysts only, whose contents have very likely been liberated.

The encystment takes place inside the capsule, yet sometimes cysts are met with which are completely free from any surrounding envelope, and, besides, are provided with a short yellowish stem attaching them to the jelly. The fact might perhaps be explained

⁷ Lemmermann (27), in his diagnosis of the genus *Salpingoeca*, speaks of the cysts in the following terms: "Cysts inside the capsule spherical or oval, with a thin membrane or naked." My observations on *Salpingoeca polygonatum* are such as to furnish us with new or different data.

by the encystment of swimming naked specimens, which hardly arriving into contact with the *Zygnema*, encysted directly, rather than building their normal envelope. Plate VI, fig. 28, which also represents a cyst of *Salpingoeca polygonatum*, such as I have seen several times, formed during the night from specimens which had been seen expanded the evening before, shows yet another kind of cyst. The animalcules in these cases contract into a perfect spherule, yellowish and shining, and besides a thin shell has been constructed also, but balloon-like and without any opening at all.

A few words might be added here, about the taxonomy. In *Salpingoeca*, a very large genus and one which soon will become much larger still, the form of the capsule is very constant, and furnishes a very good—perhaps the only good—diagnostic character. Now I could find nowhere such a description as might apply to the species just described. It is very near to *Salp. gracilis* J. Clark, but the capsule in that species is not cylindrical, being rather drawn out into a long narrow point, which appearance I never could detect in *Salp. polygonatum*.

***Salpingoeca lepidula* sp. n.** Plate VI, figs. 29–33; Plate VII, figs. 34–40.

As stated in the preceding chapter, it is sometimes very difficult to come to a precise determination of the species in the genus *Salpingoeca*; and only after much hesitation have I come to the conclusion that the present form ought to be described as new. It is, in fact, very nearly related to *Salp. buetschlii* Lemmermann, but in this latter, the larger size as well as the more rounded and swollen contour, and, more than all, the very considerable enlargement of the cup-like opening, do not allow identification with the present species. The affinity would be more evident with *Salp. amphoridium* S. Clark, and also *Salp. vaginicola* Stein, at least as Burek (6) figures them in his 1909 work,⁸ but in these the form of the capsule is not the same, being more like *S. buetschlii* in general appearance, and having a narrow pedicle which is not present in *Salp. lepidula*; this latter, also, always possesses two contractile vacuoles.

However it may be, the species which we are now going to consider was found covering in great quantities the threads of a Nostocacean, itself abundant in one of the aquaria of the Zoological Laboratory at Geneva.

⁸ In Pascher's "Süsswasser-Flora" (27), these two species are figured on p. 82. but with quite a different form from that given by Burek. It is quite possible, indeed, that Burek had studied new forms, which it would have been advantageous to give as such.

The capsule (Plate VI, fig. 29), about 14μ in height, has the shape of an urn, elegantly lengthened, resting by a broad, truncated base on a very distinct flattened cushion, which itself is applied to the substratum. From that flattened base, the lateral curve first somewhat contracts, but very soon dilates regularly, up to a distance a little above the middle of the height of the shell; then contracts again, to finally dilate in an expanded border. The protoplasmic body, rounded behind and itself elegantly urn-shaped, fills only half of the shell; the nucleus is very distinct, as a bluish spherule about the anterior third of the body; two contractile vesicles are found, one right and the other left, one posterior and the other inferior, and they regularly alternate in their function, emptying about each third minute; one of them, somewhat larger, seems to be the principal one, the other being accessory. The flagellum, about $1\frac{1}{2}$ times as long as the body, is most of the time visible only up to the middle of its length, on account of the rapid vibration of its anterior portion. The protoplasmic collar, which is particularly interesting, is mostly found with the appearance normal in *Craspedomonadina*, being like a funnel, whose height may be equal to that of the animalcule itself; but this protoplasmic funnel is subject to extraordinary deformations. The peculiar accumulation of very pure ectoplasm which generally fills the funnel all around the flagellum is seen, for instance, to move up along the funnel itself (Plate VII, fig. 40), or the very thin film of hyaline plasma which surrounds the plasmatic neck—perhaps the "Schleimhülle" or mucilaginous layer Burck speaks of—expands and covers the exterior surface; and the collar itself, now persisting, now collapsing or getting mixed with the invading ectoplasm, takes on the most diverse appearances. Plate VII, fig. 37, for instance, shows a shortened, thickened collar, whose border has especially thickened; in fig. 38, the same structures are represented, one minute later than in fig. 37; in fig. 39, at the same time that the ectoplasm expands on the inside of the wall of the collar, it climbs up along the flagellum; in fig. 40, the ectoplasmic film it seen left and right climbing upwards, many more figures might have been drawn, showing the most varied structure, for instance a film of plasma moving up on one side only and leaving the other free, or a big plasmatic spherule filling the entire opening of the capsule. Plate VII, fig. 36 gives an idea of a very peculiar process, which I was able once to follow quite at length: a big mass of ectoplasmic matter protruded from the mouth of the capsule, and became rounded, uniting with the material of the now retracted collar, and after a few minutes, from that protoplasmic spherule started lobes and thread-like protuberances, some of which got very thin and long, and at last reached down to the supporting alga and there became affixed. After a time, however, all the lobes and threads began retracting backwards. At 11 h., 10 min., the appearance was that shown by fig. 36, Plate VII; at 11 h., 30 min., everything was beginning to re-enter the shell; at 11 h., 35 min., the rudiments of a new funnel were seen

to be expanding upwards; at 11 h., 45 min., the collar was normal again, and the flagellum, which had for a time disappeared from sight, extended freely in the axis of the funnel.

The overflowings of plasmatic matter, which are frequently met in this particular species, are very little known; in some forms similar facts have been mentioned, and Burck. who, however, did not happen to meet with any such cases, speaks of the subject in the following words: "I have not found in normal individuals such formation of pseudopodia as Sav. Kent says he sometimes met with. According to this observer, Choanoflagellata may even pass through amoeboid stages. Zacharias assigns some importance to the pseudopodia in the capture of food, and does not hesitate to call them organs of prehension. Francé also observed Lobopodia in several places on the body. In my opinion such structures occur only in wounded individuals, which are not far from death."

I do not think such occurrences must necessarily be associated with a state of disease, but could not help sometimes observing a certain coincidence between the development of these pseudopodia and the abundance of food, the animalcules capturing then with increased quickness very small special organisms (sulfureous algae?) which were extremely abundant all around. But this way of capturing food is certainly exceptional; the nutritive elements are mostly thrown down straight upon the plasmatic funnel, either on its outer surface or more often on the inner surface. When the prey are very small, they seem to be digested inside the wall of the collar itself; a small shining globule, for instance, such as was mostly the case, was seen to lose by and by the sharpness of its outline, then to swell up, turn pale, and at last disappear, without having moved at any time from the place it occupied. But when the prey are caught quite near the bottom of the funnel, a vacuole immediately forms around them, and they are quickly seen to disappear downwards. In one particular case, I saw a small shining particle fall on the naked neck of an animalcule that had not yet constructed more than half its shell; it was immediately caught in a vacuole, and slowly slipped down along the surface of the body, to stop after five minutes quite near the posterior extremity (Plate VI, fig. 33). The downward course seemed to have been effected in a spiral line, but I no more than Burck could detect the least sign of a fine spiral tracing, itself representing, as Francé will have it, the border of a spirally coiled funnel.

Burck (6: page 183) discusses in a few lines the evacuation of foecal material: "As regards defecation, my opinion is the same as that of Clark and Bütschli, who observed the elimination of digested food to take place very near the base of the flagellum inside the plasmatic collar." And further on he adds: "An evacuation of ingesta at any point of the body surface, as Fisch supposes it to occur, is certainly not correct." Though agreeing with these statements in general, I should propose a slight restriction concerning the last of these conclusions: if it must be considered certain that the evacuation of foeces is not possible at all points of the body indiscriminately, an exception ought to be made at least for the plasmatic funnel; I have often seen captured granules (which very likely were not to the taste of the animalcule) slowly glide *upwards*, and when near the very border of the funnel, be suddenly hurled away (as if by a sharp undulation of the border?), and curiously enough, these very small granules or microbes, which were probably provided with invisible flagella, after having proved quite inert and unmoved as long as they were included in the vacuole, when cast out at once began to toss about in a rapid dance, soon disappearing.

On the 9th and 10th of February, I met with a considerable number of small naked Flagellates (Plate VII, fig. 34), which could be referred without any hesitation to this same species; the size, the two contractile vesicles, nucleus, flagellum, protoplasmic collar, everything, in fact, indicated specimens which had left the shell and had adopted a free life. They swam quickly about, in small circles, without ever getting very far away; or they went straight forwards, for a distance hardly more than five or six times their own length, then stopped for a second or two, darted forwards again, and so on for a long time, proceeding by sudden intermittent advances. Perhaps some correlation might be supposed to exist between this sort of progression and a very curious fact, other examples of which are hardly to be expected in the whole series of the Flagellata, but which could easily be ascertained in each of the specimens observed, namely, that the flagellum, instead of *drawing* the body, was *pushing* it from behind; the flagellum, in fact, is posterior. But the small animalcule has itself changed in shape, it has shortened, and at the same time has taken the form of a top, pointed in front (in front when swimming, in reality it is the hind part of the body), and as for the plasmatic collar, it is seen reduced to one-quarter of its former length, but is rather thick and very

distinct and still. The most interesting fact about that change in shape is perhaps the pointed extremity which never exists in the resting stage, and certainly seems an adaptation for swimming.

Plate VI, fig. 30 illustrates a case of division, nearly completed, such as I met with on the 8th of February. Very likely the process had been the same as that described in the previous chapter, for *Salpingoeca polygonatum*. The new Flagellate, ovoid in shape, is seen about to draw its flagellum from the shell it has just left, and beginning to glide down towards the supporting Alga. It is seen about $\frac{3}{4}$ of a minute later, nearly touching the ground but with its flagellum still attached to the border of the cup (Plate VI, fig. 31); one minute more, and the flagellum was free, pointing straight upwards, the protoplasmic collar had begun to develop, and the inferior extremity had become pointed. Very likely the rudiments of a new capsule were already beginning to appear; but at that very moment, the supporting *Nostoc* passed into some rubbish and was lost to sight. Other specimens, however, were found that same day and the next, at the stage just described (Plate VI, fig. 32), and they allowed of further observations:⁹

Immediately after fixation, the little body takes the form of a long top, with a distinct plasmatic collar, in which food particles are already caught; but the characteristic posterior point immediately changes into a very fine thread, and as the body gets higher and higher, leaving the ground behind, the thread gets longer, being just sufficient to prevent the escape of the Flagellate, but certainly unable to keep it upright. The body, in fact, is kept upright by a very thin envelope, which has already formed, the appearance being that of an egg in its cup (in Fig. 33, Plate VI, dotted lines indicate the rudiments of the shell). The new envelope is so thin, that one hardly can detect it, like two fine lines left and right of the point of fixation, and which diverge more and more to meet the body in its most swollen portion. The animalcule, in fact, rose while propping itself against the very borders of the partly constructed cell; but after a normal height has been reached the body ceases to get higher, the posterior thread disappears, the animalcule swells and moulds its body into the very form the shell will invest afterwards, and deposits all over its own surface a very thin pellicula, then retracts when the pellicula has become hard.

⁹Several of these specimens seemed from their particularly large size to represent adults, which had left their shell without previously dividing.

The capsule is now nearly complete, and its walls soon will grow thicker; but one thing is wanting, namely the neck, or rather its widened border; and now—if two observations, both agreeing, suffice for the statement—the difficulty is removed in a very ingenious way. The animalcule lengthens somewhat, then bends first to one side (Plate VII, fig. 35), then to another side, leaving some material behind, acting in fact like the finger of a potter about to broaden the aperture of a cup, but here the displacements are exceedingly slow, very likely because, before leaving the contact portion of the border, the animalcule must wait till the deposited film is hardened.

From my observations, the construction of the capsule takes a long time, from morning to evening; but it is quite possible that in nature things go much quicker, owing to more favorable conditions.

Chrysamoeba radians Klebs. Plate VII, figs. 41–44.

Chrysamoeba radians, which Klebs described in 1892 (21), is not rare, and yet remains little-known; every observer has seen it, but very few have gone to the trouble of studying it at length. This study, it must be said, is little encouraging in itself, doubts and uncertainties are met with on many points, contractile vesicle, chromatophore, flagellum, division, capture of food, even the very existence of this Flagellate as a distinct species has been doubted, and so many little organisms are met with, whose study looks more profitable, that this particular one is easily neglected.

Scherffel, in 1901 (29), treats in a few pages of this little organism, and says in regard to the flagellum: "Besides the pseudopodia a swinging flagellum is sometimes seen, probably only when the amoeba is about to change to the Flagellate state, but as a rule there is none." A little further on, he says concerning animal feeding: "Klebs was not able to observe the capture of foreign bodies, and Senn says, in 1900, holozoic nutrition has not yet been observed. Yet in 1890 I had observed in a vacuole a little rod with the appearance of a Bacterium. This year in the spring I was able to verify the direct capture of green Algae and the evacuation of brown undigested remnants of food." Later on, in 1911 (30) the same observer, in his chapter under the title "*Chrysamoeba* and *Chromulina nebulosa*," seems to doubt his former observations about a flagellate stage, thinking the observed Flagellates might not have belonged to *Chrysamoeba*. "I consider more and more as probable

the opinion that the genus *Chrysamoeba* is in fact a purely amoeba-like form, with never any flagella, comparable to those of organisms like *Chromulina* or even *Ochromonas*, but owing to this very absence of flagella, these forms are so characteristic in themselves that it seems advisable to retain *Chrysamoeba* as representing an independent genus."

Pascher, in the fascicle of his "Süsswasser-Flora" (27), which treats of the Chrysomonadina and is dated 1913, does not even mention the name *Chrysamoeba* in his list of accepted genera but only devotes a few lines to the subject, in a foot-note on page 13: "Klebs has created the name *Chrysamoeba* for *Chromulina*-like Chrysomonadina with two large chromatophores and an anterior contractile vesicle, which may turn into Rhizopods and develop pseudopodia after losing their flagella." In the same work, on page 90, Pascher comes again to the subject, and considers this same organism as belonging to the genus *Rhizochrysis*, "an artificially created genus that includes several Chrysomonadina of different origin, whose Flagellate-stage has been lost or in which, if present, it is not yet known." *Chrysamoeba*, such as Scherffel understood it, has now become *Rhizochrysis scherffellii* Pascher.¹⁰

During these last four years, while looking for Infusoria, I have often met with *Chrysamoeba*, in several localities and in all seasons of the year; and at the end of 1914 and the beginning of 1915, I devoted some time to its study (perhaps it is not quite useless to state that most of my collections of material were made after breaking a thick layer of ice), and was able to come to some interesting conclusions. The little organism I had to do with was, I must say, at the same time, *Chrysamoeba radians* Klebs, *Rhizochrysis scherffellii* Pascher, and also the *Chrysamoeba*-like *Chromulina* Scherffel speaks of. In my opinion, one single organism is here concerned, *Chrysamoeba radians* Klebs, a very distinct and characteristic species and genus.

Let us first insist on the fact that *Chrysamoeba* is a colonial organism. Scherffel, in 1908, sometimes found "large colonies of *Chrysamoeba*-like amoebae, where more than a hundred typical and well-developed specimens, all without any flagellum, were included in an amorphous, free-swimming jelly." At Pinchat, these colonies were very abundant, sometimes very much reduced and

¹⁰ According to Pascher, the *Chrysamoeba* which Scherffel observed is not the same as that described by Klebs.

with only a few individuals, sometimes with 50 or more, and even 100; in one particular case, one of the colonies seemed to contain about 200 little amoebae; there are no limits, in fact, to the size of the colony, and as for the isolated specimens, which, it must be said, are always met with in greater numbers, they may very well be supposed to have been detached from the colony.

If we now look at one of these little *Chrysamoebae* (Plate VII, fig. 41), we shall recognize a small amoeba, 15 or 18 μ in diameter, star-shaped or made more or less irregular by thin clear pseudopodia, finely granulated superficially, sometimes bifurcate or rarely branching, and whose length can be double the diameter of the body. These amoebae very slowly change in shape, and hardly in position, and the pseudopodia are seen to change also, retracting or reappearing, but without seemingly playing an important part in the locomotion of the animal.

The plasma, very clear, and often with many small vacuoles, contains a pale nucleus, whose structure is rather exceptional; most generally, a central caryosom is to be seen, around which is a narrow annular ring of light liquid substance, then an exterior ring of more compact matter; sometimes, however, only small vacuoles are seen in a homogenous grey nuclear substance. The nucleus is generally indistinct, hidden from view by the more evident chromatophore. This latter is in the form of a large golden-brown lamina, crescent-curved; it very often looks double, being first lengthened, then bent in its middle so as to acquire the form of the letter V. The contractile vesicle, very small and in an eccentric position, often can hardly be distinguished; its activity is seen to be very slow, and some patience is needed to become sure of its periodic emptying and filling, but I could ascertain that it functions normally, though its reappearance after closing is very slow. Here and there are seen scattered in the clear plasma more or less numerous small shining granules, and sometimes a large rounded mass of leucosine is found, of a very pure bluish grey. There is no stigma, and as for a flagellum, only in very rare instances is one to be seen, extremely thin and very slowly undulating; and its occurrence is always a sign that the amoeba is beginning to prepare for its swimming Flagellate form.

It is rather curious that the question of the capture of food should have been so long obscure, and still is so. Klebs could not ascertain its reality, nor did Senn observe more about it. Scherffel, however, as we said before, proved the fact, leaving no doubt at all. For my part, I observed in many instances the capture of small green particles, and more especially certain large (sulfureous?) two-segmented bacteria, which happened to come into contact with

the amoeba and immediately were enclosed in a vacuole, soon disappearing inside the body, sometimes the pseudopodia were the means of capture, and the bacteria were seen to glide along them towards the central plasma. On two special occasions, diatoms were met with, nearly as long as the *Chrysamoeba* itself, and in course of digestion.

Such is the amoeba form of *Chrysamoeba radians*; but there is another form, that of a typical Flagellate, which Klebs had already seen and Scherffel afterwards described, only to doubt later his own observation and believe in a confusion with another organism. My observations, however, are such as to leave no obscurity. *Chrysamoeba* really passes through a flagellate state, or rather, one might say, voluntarily abandons one state for another. I have made, between December 29 and January 3, several experiments on the subject, which all gave the same results, five colonies of *Chrysamoeba*, nine, thirteen, twenty-four and fifty specimens in number respectively, were isolated on five excavated slides in clear pure water, and the amoebae were seen one after another to leave the jelly, which after two, three and four days was quite free of any tenant, while small Flagellata were swimming about. As an example, I may give here a textual copy of the brief notes taken for the smallest of these colonies:

Dec. 29. 12 o'clock. Nine fine specimens in their jelly; not one of them showing any flagellum; all are expanded as small star-like amoebae, 15 to 18 μ in diameter.

4:30 o'clock. The same.

Dec. 30. 8:30 o'clock. Only four are left, a single one of them still in the star form; the others are rounded, and two of them quivering; on one of them I can distinguish the slowly undulating flagellum.

9 o'clock. The undulations are more rapid.

1 o'clock. Nothing is left in the jelly, and a small flagellated individual is swimming about.

On three or four different occasions, I was able to follow in one single animalcule, from beginning to end, the passage to the flagellated state. The amoeba slowly retracts its pseudopodia, then becomes spherical, and begins quivering from time to time, but without the flagellum, still too delicate, being yet visible; but it soon becomes distinct, and ten minutes after the first quivering of the spherule, it is seen rapidly to vibrate at the anterior pole of the now ovoid or pyriform animalcule; this latter then moves, leaves the jelly, and goes in a straight course, revolving on its long axis and swinging in a pendulum-like movement.

This *Chrysamoeba*-Flagellate (Plate VII, fig. 43), 18 to 20 μ in length, is ovate, with the broader extremity either anterior or posterior according to the individuals, sometimes it is somewhat stretched behind. It contains a distinct, curved chromatophore, a small contractile vesicle near the anterior extremity, very small shining granules, and often a large spherule of pure leucosine; the nucleus generally remains indistinct, hidden in the curve of the golden-green chromatophore; the flagellum, very thin, hardly longer than the body, takes its origin from a very small notch, above which the anterior extremity rises in a small prominence.

After swimming about for a time whose duration I could not make sure of,¹¹ the Flagellate again comes to the amoeba stage, and contracts into a spherule (Plate VII, fig. 42), the surface of which soon begins showing small projecting denticulations, then each of these protuberances develops into a very thin pseudopod, which soon thickens, at the same time the flagellum gets more indistinct, it is thin, flabby, and remains for a long time at rest; now and then, however, it seems to come to life again, and oscillates for a brief moment; and finally it disappears, either collapsed, or rather—if a single observation entitles to a judgment—resolves into a chaplet of tiny pearls, which are lost by and by.

Division has rarely been observed. As far as I know, Klebs and Scherffel alone have mentioned a few cases, and one cannot but be somewhat surprised at the rarity of the occurrence, when thinking of these big colonies whose constituent members might be supposed to arise from a single primary individual. As it is, I was able to verify a few cases of division, but only one of these could be studied at length. The animalcule was found already somewhat stretched in length (Plate VII, fig. 44, *a*), and was provided with two chromatophores, still united, which together had the shape of a *W*; to the left, a big mass of leucosine; to the right, a very large vacuole. Two minutes after that first observation, the chromatophores were separated, the vacuole had grown bigger still, and the leucosine globule had elongated (Plate VII, fig. 44, *b*); a little later, the 8-form of the body was much more apparent (Plate VII, fig. 44, *c*), the leucosine body was still more elongated; the big vacu-

¹¹ The resting or amoeba state, whose duration is not difficult to notice, can last for days, but this duration may also be much reduced, and I have seen: for instance a flagellated individual transform into an amoeba and develop pseudopods; but two hours later the little organism had disappeared again as if not satisfied with the new condition.

ole, after having acquired an immense size, burst and disappeared (Plate VII, fig. 44, *d*); the leucosine globule became divided into two parts, one of which passed to each of the new individuals just when the bridge between them was breaking (Plate VII, fig. 44, *e*); and the two new amoebae slowly went their way (Plate VII, fig. 44, *f*). The whole process, from *a* to *f*, had lasted twenty minutes. At no time had it been possible to detect the least indication of a flagellum. Scherffel, in the first case he studied, observed (1911, p. 315) that one of the new individuals, long before the separation, already possessed a slowly oscillating flagellum, but later on, when he again had the opportunity to observe a second case of division, he found that neither of the new individuals ever developed any. For my part, I consider it quite possible that in both cases Scherffel had seen rightly: in the first one, the amoeba immediately prepared for the flagellate stage, in the second it remained an amoeba.

But if this case of division is the only one I could study at length, there is another which I should like to mention, which though not proving successful at last, is indeed hardly less interesting. The amoeba, when found, was already narrowed in the middle, and in possession of two distinct chromatophores, each of them in a *V* form, but united together by their adjacent extremities, like a *W*; so firmly united, in fact, that when but a narrow bridge alone separated the two new individuals, one of the chromatophores, which should have entered the new individual, had not been able to follow the movement, and remained in what we might call the "old" individual, while the "new" animalcule, quite deprived of any green matter, was just going away. A very narrow bridge, however, a mere protoplasmic thread, was still uniting the two amoebae; but danger was coming, an air-bubble approaching more and more, and to get rid of it I added some water to the side of the cover. The bubble retracted, but, as a consequence of a violent temporary shaking, the couple seemed to give up dividing, the bridge got wider, and by and by the new pale individual slowly "re-entered" the old one; after a moment a single amoeba was seen, with two chromatophores instead of one. But without that disastrous commotion, certainly an entire separation was quite near, and the new amoeba would have been colorless, just like the specimen which Scherffel once found, and figures on Plate VI of his 1901 work.

To conclude with *Chrysamoeba*, I ought perhaps to speak of the encystment. Some observations have been made which allowed curious conclusions, so curious, indeed, that . . . it would be

better not to mention them, as possibly they relate to some other organism.

Chrysopyxis bipes Stein. Plate VIII, figs. 45-49.

"*Chrysopyxis bipes* has often been discussed in the literature, and yet seems to me not to be at all well understood in its organization." Such are the words with which, in 1911 (30), Scherffel begins his chapter about *Chrysopyxis*, and though the following pages of the work threw a good deal of light on the most interesting points, it will not be quite useless to report some further observations here. But before relating my own experiences, I should like to reproduce the lines with which Scherffel introduces the subject:

"According to the existing descriptions, *Chrysopyxis* is a flagellated Chrysomonad, provided with a shell. According to Stein, the animalcule is in possession of two flagella. Other observers, like Lemmermann, and Pascher, are of the opinion that there is only one flagellum. Iwanoff (1899) tried to explain these different statements by the fact that normally a single flagellum exists, but that this under special circumstances appears ravelled out in threads, so as to look branched. The two flagella of Stein would thus be reduced to a single branched one. Pascher (1909) accepts Iwanoff's opinion, and gives in his Plate XI, fig. 2b, a hypothetical drawing of a specimen in which the individual threads of the branched flagellum are wound up together at the base, and so explain the simple, thick, basal part of the flagellum. I had myself a good many occasions to observe *Chrysopyxis* in life, but I never succeeded in distinguishing an undulating flagellum, nor that "ravelling into threads" (Zerfaserung) which Iwanoff and Pascher speak of, and the existence of which I must confess to being very skeptical about."

Chrysopyxis is often met with, but my observations upon that interesting little Chrysomonad nearly all refer to a single station, that same shallow marsh at Pinchat where so many Protozoa have been found, and where in the spring of 1916 it was seen to cover in great numbers the long threads of *Zygnema*.

The capsule (Plate VII, fig. 45), about 13 μ in length, is ovoid in shape, and at the same time pyriform, its anterior extremity being drawn into a very short tube, which, however, is hardly distinct enough to deserve the name. This little case stands upright on the vegetal filament, posteriorly drawn to one side in a very thin thread which turns down around the *Zygnema*, and describes a

complete circle to rejoin the base of the cell on the opposite side.¹²

In most of the specimens, the capsule is quite colorless, but with age it grows yellow; it is mainly of a cellulose nature, as is easily shown by the chloride of zinc reaction. Iwanoff (19), however, speaks of the violet coloration as only in the shell, the annular ring remaining colorless. Yet I have seen that very ring distinctly colored, and probably Iwanoff's negative results were due to a defective quality of the reagent.

The protoplast itself, which hardly fills one-half of the capsule, contains a large olive-green or olive-golden chromatophore, in the form of a curved transverse lamina; then very small pure and shining globules, often a large spherule of leucosine, and, in the anterior part, a large vacuole, or sometimes two. Does this vacuole, or one of them, represent here a contractile vesicle? Iwanoff indicated it as such; but in one of the observed individuals I happened to see, at the posterior extremity, a very distinct vacuole suddenly collapsing, just like a normal contractile vesicle, and it may be asked if its true position would not be there, the anterior vacuole being concerned with the capture of food? A nucleus was not seen, being hidden, very likely, in the concavity of the green lamina. Iwanoff, however, mentions the existence of "a small nucleus, somewhat above the middle." As to the pseudopodia, which we must consider somewhat more at length, the spherical protoplast does not reach with its upper extremity so far as the aperture of the shell; it appears, in fact, suspended inside the cavity, and held in place by means of a plasmatic stalk, which arising from the median upper point of the body, goes straight to the mouth of the shell. But there, at the very opening, this stalk abruptly divides into four, five, six, and up to eight lateral threads, which diverge in all directions; they are very thin, smooth and rigid, genuine pseudopodia, in fact, and they behave as such; tiny microbes are caught, slowly glide towards the mouth of the shell, then reach the central stalk, along which they are seen to descend with a ten-fold rapidity. It often happens, when the fishing district proves rich, that the captured microbes come down in too great numbers, and are then obliged to accumulate, waiting for their turn; it is, indeed, a very interesting sight to notice them swallowed one after another down the main trunk (Plate VII, fig. 49).

I have never been able, among these rigid pseudopodia, to detect any appearance of a flagellum, nor any transformation of a rigid thread into a swinging one, and my own observations entirely confirm those of Scherffel (30), when he says: "Then also with *Chrysopyxis* animal-like ingestion of food occurs!" and when he adds:

¹² According to Iwanoff (19), the construction of this ring is effected in a very curious manner: the animalcule, in the state of a naked zoospore, turns several times around the *Zygnema* thread, depositing behind itself a fine train of mucilaginous matter, which soon will harden into a complete ring.

"The protoplasmic body does not possess any flagellum, any more than does the amoeba stage of *Chrysamoeba*."

"The protoplasmic body does not possess any flagellum, no more than does the amoeba stage of *Chrysamoeba*."

But here also, as in *Chrysamoeba*, a flagellated state may appear, not only after an act of division,¹³ but as the result of a total transformation, a process hitherto unknown in *Chrysopyxis*, but which I happened to verify on several occasions: the body becomes spherical, the pseudopodiar retract, and the little spherule begins quivering in its cell, a flagellum, in fact, is there already; then the spherule lengthens, reaches the aperture, becomes swollen anteriorly, so as to press on the tubular opening and force the exit (Plate VII, fig. 47), and finally leaves the cell. It looks now almost like a small flagellated *Chrysamoeba*, yet relatively broader and more rounded, with an anterior rapidly swinging flagellum, a normal chromatophore, small granules and often a leucosine body (Plate VII, fig. 48).

Both figs. 46 and 49, Plate VII, and especially the latter figure, represent cells which are entirely without the normal tubular extremity. A good many such specimens were met with, generally smaller than the type, about 11 or 12 μ in length as well as in breadth. Were they young individuals? or was it a different species, perhaps Lauterborn's *Chrysopyxis stenostoma* (Süsserwasser-Flora," p. 28, fig. 43), which, however, is described as possessing two chromatophores. At any rate, it is well to reproduce here the words accompanying Pascher's diagnosis of *Chrysopyxis*: "a genus too little studied, and whose several forms are relatively little known."

Hyalobryon ramosum Lauterborn. Plate VIII, figs. 50-54.

In that same marsh at Pinchat was often found, in every season and often in great abundance, the Flagellate for which Lauterborn (23) created the name *Hyalobryon*. "The present genus of *Chryso-monadina*," says the German observer, "deserves its name rightly to this extent, that it is positively difficult to distinguish clearly

¹³ Plate VII, fig. 46 shows such a case of division, which is well known today, whose process Pascher summarizes in the following words ("Süsswasser-Flora," p. 28): "Multiplication by longitudinal division of the protoplast, after which one of the parts leaves the shell in the form of a zoospore with a single flagellum." In this fig. 46, it is to be noted that, in spite of the process being already very far advanced towards its end, one pseudopod was still to be seen, relatively thick, and pointing straight up; microbes were still caught, and slowly glided along towards the body.

even the outlines of the colonies; as a rule one sees only the numerous golden-brown Flagellates, placed next to each other, without its being possible to decide how they are arranged."

"*Hyalobryon* constitutes, like the well-known *Dinobryon*, tree-like or brush-like colonies, but which, different from the latter genus, do not swim freely about, but are fixed on water-plants or any other substratum. The number of the individuals united into a colony is very variable and sometimes goes to a hundred. Like *Dinobryon* the Flagellates inhabit special capsules, which here are of a tubular form and often are more or less, even strongly, bent; the basal extremity terminates in a short cone. Towards the anterior end, the tubes become somewhat narrower, and at their border look finely toothed. This apparent denticulation is due to the fact that the Flagellates, which always stand near the aperture of their capsule, periodically leave here a deposit in the shape of new rings of growth, on the inside of the somewhat enlarged border. As the process is often repeated, the tubes lengthen more and more; and many of them are seen, whose anterior part is formed of ten and more rings, resting cup-like in each other."

My observations are such as to confirm in a general way those of Lauterborn, but the accordance is not complete in some of the details. In the *Hyalobryon* I had the tubes were never narrowed near the summit; on the contrary, they were perfectly cylindrical up to very near their distal extremity, where they somewhat expanded (Plate VIII, fig. 50) instead of narrowing. Lauterborn's "Anwachsringe," or so-called "lines of growth," were mostly absent; sometimes, however, they were present, either on some of the members of the colony, or more rarely on nearly all of them, but they could in no case be considered as rings of growth; they were tubes, set in each other, each of them of some length (Plate VIII, fig. 54). There was even no difficulty in ascertaining the manner in which the construction had been accomplished; little Flagellates approaching had undoubtedly become attached just *inside* an empty tube, very near the opening and on one side only of the wall, then they grew up, forming first a whistle-like, then a regular, tube. Plate VIII, figure 54, shows this special arrangement of the new tubes inside the old ones, and at the top is seen, in the form of a simple sharp scale, the beginning of a tube whose construction was not continued, the Flagellate having, it must be supposed, left the place very soon after finding it.

It would then be necessary to modify the terms used by Lauter-

born concerning the fixation of these Flagellates: "While in *Dinobryon* the younger cells are set *inside* the inner border of the old ones, in *Hyalobryon* it is the *outside* wall that is chosen as a point of fixation, and this point is very far from the aperture." Now there seems to be here some misunderstanding, Lauterborn is here speaking of the fixation as quite a different thing from the "lines of growth," which latter would in his opinion point to a single individual building a formal row of rings above each other, while according to my observations there are no "lines of growth" at all, but the animalcules would settle down in two different ways: either inside empty tubes, as we just described, or outside and generally very far away from the opening, these latter individuals would enlarge the colony in size and breadth, the former would only lengthen the existing tubes.

The second way, by simple juxtaposition, is by far the more frequent of the two (at least it was at Pinchat), and colonies are formed, whose appearance is very curious and variable, now it is a branching thicket, now the tubes seem to start from a single point (Plate VIII, figs. 51, 52), now they are parallel to each other, now straight or very often in a contorted bundle (Plate VIII, fig. 52).

The small inhabitant of the tube is indeed of a very timid nature, and leaves its tube at the first appearance of danger, the very transportation of a colony from the general collection to an excavated slide for purpose of better observation is enough to cause more than half its members to escape during the journey, and those which still are left also very soon take to flight. It is quite probable that the animalcules are just as ready to settle down as they are to leave, and empty bundles of tubes may very well get the preference, they then affix themselves either against or inside the tubes, but in this latter case quite near the opening, and according to the conditions the changes may be of such frequency that after a time a formal set of rings are seen one behind the other.

As for the tubes themselves, whose length may reach as much as 150μ (Lauterborn speaks of 55μ) for only 5 or 6μ in breadth, they are perfectly colorless, and "for an exact study it is necessary to have recourse to staining, which does not present any difficulty, as they very quickly absorb aniline colors" (Lauterborn). I may add that Dahlia tincture instantly colors the tubes a very fine peach-blossom tint, but this lasts only for a moment.

The Flagellate, 18μ in length and 3 or 4 in breadth, is spindle-shaped, with at its anterior extremity a short beak-like prolonga-

tion, and, behind, it is drawn out into a point, itself continued in a very thin thread, whose length may be nearly double that of the fusiform body (Lauterborn calculates it to 12μ ; but I have seen it attain 30μ and more), and which attaches by its extremity far away on some point of the inner surface of the tube. This attaching filament is highly retractile, and from time to time draws the animalcule very far inside the tube. Its normal position is at some little distance from the opening. In the anterior part of the body is seen the chromatophore, a golden-brown lamina, but which only appears distinct on one of its sides, where it is seen double because of its recurving there on itself. Sometimes it looks broken in its middle, and the appearance is that of two rods joining each other at an angle. At its anterior extremity is a very small, but distinct stigma. In the same part of the body is a small contractile vesicle (Lauterborn found two), and behind the chromatophore lies generally a large, egg-shaped mass of leucosine; in the very pure and transparent plasma, tiny shining granules are disseminated; a very pale globular nucleus, with a small central caryosom, occupies the middle of the body, being mostly very indistinct on account of the chromatophore, in the folds of which it is lost. From the slight notch that is seen at the anterior extremity, two flagella arise; one of them, the principal one, about as long as the body, swings in rapid longitudinal vibrations, while the other, the accessory flagellum, only 5 or 6μ in length, remains motionless at an angle of 35° to the former.

A little further consideration is necessary as to the systematic position of this small organism. Lauterborn did not unhesitatingly propose this Flagellate as new. As far back as 1890, Imhof (18) had described, with the name of *Dinobryon buetschlii*—but in a few words only, and without any accompanying figure—a small Flagellate, very similar indeed to Lauterborn's *Hyalobryon*, but in this form the tubes are expressly stated to be set one within another, and nothing is said of the characteristic "rings of growth."¹⁴

The form I studied also looks rather different from Lauterborn's *Hyalobryon*, and this typical insertion of the tubes, in place of Lauterborn's "rings of growth," would seem to indicate another species, perhaps Imhof's *Dinobryon buetschlii*? But Imhof insists on the fact that in his *Dinobryon* "the anterior third part of the tube grows gradually narrower, down to one-third of the diameter next to the opening," while nothing of the sort is to be seen in *Hyalobryon* as I could verify in hundreds of specimens. Perhaps a third species

¹⁴ Stokes' *Epipyxis socialis* (34), which presents some likeness to *Hyalobryon*, seems to me, even more perhaps than to Lauterborn, very different from *Hyal. ramosum*.

is in question, or a particular variety, but the facts are not clear enough to allow any definite conclusion.

Cryptomonas ovata Ehrenberg. Plate VIII, figures 55-57.

Pascher, on page 105 of the second fascicle of his "Süsswasser-Flora," accompanies the diagnosis of the genus *Cryptomonas* with the following reflections: "A very widely distributed genus, that sometimes forms 'water-flowers' (Wasserblüten) and is frequently associated with Euglenae; is particularly frequent in water rich in organic substances and in sewer refuse. Nearly all of the forms are also planktonic. Only few of them are known, and an exact study would furnish with a swarm of species." In a note at the foot of the page, Pascher adds: "I hope to give within two years a detailed monograph of the freshwater Cryptomonadinae." To my knowledge, the work has not been published yet, and any information about this interesting, somewhat paradoxal little group, might have its importance.

Cryptomonas is indeed found everywhere, but most of my observations, dating from 1916, have been made on specimens from that same marsh at Pinchat of which mention has so often been made; later on, in January, 1917, a collection was studied from another station, Rouelbeau, where individuals were found at rest, enclosed in a gelatinous envelope, and often in course of division; and lastly, in December, 1918, a special form from a pond at Florissant, in the near neighborhood of Geneva, was studied again. In all these different stations, the species was the same—the same, at least, after determination by means of the keys in "Süsswasser-Flora"—namely, *Cryptomonas ovata*; but such was the difference between the forms of Pinchat and Rouelbeau on one side and Florissant on the other, that one might ask if it was right indeed to reunite finally Ehrenberg's two species *ovata* and *curvata* into one (*ovata*). The Pinchat-Rouelbeau type was in fact *Crypt. ovata* (with the variety *curvata* Lemmermann), and the Florissant type was the genuine *Crypt. curvata* Ehrenberg.

Ehrenberg, on page 41 of his classical work ("Infusionsthierche"), gives the following diagnosis of *Cryptomonas ovata*: "Monad with an oval carapace, with compressed body, oval, large, twice as long as broad, $\frac{1}{24}$ millimeter in length, color green." Pascher (Süsswasserflora, p. 105), in his diagnosis of the genus, describes the general appearance in more precise terms: "Cell typically showing dorso-ventral differentiation, with generally a more flattened or even somewhat concave ventral side and often a highly convex

dorsal side, which at the anterior end is not infrequently drawn out into a point. Anterior end diagonally truncated. . . ." In spite of all descriptions, however, it would be very difficult to recognize a *Cryptomonas* without a few explanatory figures, so much the more, that the form of the body is exceedingly variable, from that of an egg to that of a curved spindle. The size also varies within very wide limits, most of the specimens measure from 30 to 55 μ in length, but some are very much smaller. At the end of September, for instance, a multitude of very small individuals suddenly appeared, which though certainly belonging to this species, measured only from 12 to 13 μ (Plate VIII, fig. 56), they were nearly oval in form, but grew nearer and nearer the typical form, in the same proportion as the size augmented.

Let us now consider in its more intimate structure, such an individual as is shown by Plate VIII, fig. 55, which represents fairly well the typical *Cryptomonas ovata*. The organism is seen with its ventral side to the right, the dorsal convex one to the left, terminating in a point, or beak-like extremity, the posterior part of the body is rounded, the anterior diagonally truncated, and hollowed into a depression whose deepest part is nearer the ventral side.

The most exterior part of the body is represented by a colorless periplast, of a cellulose nature, in the substance of which extremely fine granulations are dispersed, whose significance, as we shall later see, is that of trichocysts. Inside the colorless investing layer are the chromatophores, olive-green as a rule, in the form of two curved laminae which are applied to nearly the whole inner face of the external layer, and joining each other by their respective borders with such precision that one might think of one chromatophore instead of two. They are, however, not very distinct, except on their right and left sides, on account of their being seen there through a greater thickness. The green laminae are paralleled on their internal face by a continuous sheet of grains of starch, sometimes so much pressed against each other as to deform into hexagonal facets, but always making only a single layer. These starch grains must be regarded as a direct product of the chromatophores, and at the same time as a food-reserve, for they disappear in twenty-four hours with unfavorable conditions of life. Besides these amylaceous grains, others of quite another nature are found; large shining bodies, very generally two in number (sometimes one and rarely three) showing indistinct crystalline forms which might apparently be referred to the hexagonal system; they are always found in the same position, not far from the dorsal side, and just dorsal to the characteristic "cage" that will be spoken of later. These special bodies, which might be compared to the oxalate crystals of Rhizopods and Infusoria, are nearly always present, an interesting fact

to note, in comparison with *Cryptomonas curvata* where they never exist. Very near the anterior extremity, and under the dorsal prominence, is a very distinct contractile vacuole, which collapses about every half minute, slowly to fill up again. The nucleus, lying in the posterior region, is round, very large, very clear, and has a small central caryosom. Around the nucleus is clear, pure protoplasm, in which are dispersed shining globules of an extremely small size, whose appearance is that of leucosine. The two flagella are seen to start from the base of that beak-like prolongation that terminates the dorsal side of the body, but they arise nearer the ventral than the dorsal side, that is to say, on the ventral wall of that deep cavity which has been erroneously called the pharynx. When the little organism is swimming, nothing can be seen of the flagella; at rest, one of them is generally seen rolled into a wide curve, on the ventral side of the body the other extending backward, on the dorsal side. In one single instance, and in a very much compressed individual, whose body was spread into a broad layer, I was able to detect a very small basal granule. The pharynx is a deep, tubular or, more exactly, fusiform *fossa*, which plunges into the body down to the middle of its length, and even sometimes lower. At its lower end, this cavity is conical; near the upper end it narrows to a tube, then again somewhat expands, and opens funnel-like to the exterior. It is now seen to be carpeted, all along its inner wall, by a continuous sheet of clear granules, in one single layer and in perfect setting, disposed in such a manner that the eye can divide the surface either in longitudinal or in diagonal parallel lines, in two series crossing each other (somewhat like the appearance of the shell in *Arcella* or, better, *Cyphoderia*.¹⁵ In reality, these small granules or pearls are disposed along diagonal lines going from left to right and from above below, and constitute a kind of "cage" whose lower end reaches far down into the pit, and whose anterior end suddenly terminates in a broad truncature. The number of the diagonal rows may be counted (in big specimens at least) as sixteen, and each row comprises about the same number of pearls also, so that we arrive to a total number of 256 pearls. The cage, however, if my observations are right, is not absolutely continuous; it seems to be split on one of its sides, the dorsal one, and from end to end, one of the borders of the longitudinal fissure being somewhat incurved; the whole cage, in fact, might be compared to an enrolled leaf, whose edges do not completely join. The layer of pearls, as we said before, carpets the inside of the pit, but the actual form of the pit is not easy to determine; it is neither a tube nor a fusiform cavity. Could we suppose, for instance, liquid plaster to be cast into the fossa and then removed in the hardened

¹⁵ Bělar (4) gives these grains, in *Chilomonas paramaecium*, as forming 8 longitudinal rows, with 10-16 grains for each row. In *Cryptomonas ovata*, which differs from *Chilomonas* only in the possession of chromatophores, the grains are more numerous, and the rows also.

state, it would perhaps give a figure somewhat in the shape of a very thick spoon without a handle.

In regard to the significance of this tessellated cage, Bêlar (4), in his chapter devoted to *Chilomonas paramaecium*, has studied the subject somewhat at length, and says: "I should not, as Nägler does, consider these granules as supporting elements (stützende Gebilde), but rather apply that term to the fibrillae on which they are set, and whose existence, if not clearly proved, may be inferred from the regular arrangement of the granules, and which in face-view could occasionally be seen indicated in Iron-Hematoxiline preparations. . . . Rather must these granules be considered as rudiments of the jelly-trichocysts (Schleimtrichocysten) of the Cryptomonads. . . . Künstler's and Uehla's statement, that, after the crushing of the animalcule, threads come out of the pharynx, which had not been there before, I can confirm myself, a fact, however, which can but very rarely be observed."

My own observations are also such as to confirm the existence of the ejected threads, I have seen them on three different occasions twice in the living animalcule and once after the action of sublimate, but they are so very thin, so difficult to observe, that I did not, at the time, consider my observations as sure, and I should hardly dare to mention their existence, if my sketches, which date from a time when neither the works of Bêlar nor those of Künstler or Uehla were known to me, were not in accordance with those of the Austrian observer.

After these considerations upon these special granules, Bêlar passes to a somewhat different subject, which we must also treat of here: "We might speak now of the superficial "trichocysts" of our Flagellate. Bütschli was the first to observe them, after him they were described by several authors, lastly by Alexieeff; Dangeard and Nägler do not mention them. They appear as more or less rigid, fine threads from 10 to 30 μ in length, which cover the whole surface of the body. They were mostly found after treatment of the animalcules with acetic acid. I have examined living individuals, as well as others treated by acetic and other acids, but without succeeding, either with the simple microscope or by dark-ground illumination, in finding anything of the sort. Only after fixation with osmic acid and coloration by Löffler's method for flagella, could I distinguish these elements, but then they were found in every one of the individuals. They do not color intensely, but are sufficiently visible. Each of the animalcules seems to be surrounded by an

assemblage of fine supple threads. These threads have received many explanations. Bütschli considered them as trichocysts, homologous to those of the Ciliata; Künstler as dead pseudopodia; Lanessan as cilia, which are rendered invisible by interposition of mucilage. In my opinion the first of these explanations has the more probability. These thread-like elements, indeed, are only found on dead animals, for if present in life they would not escape observation, owing to the obstacle they would profer to locomotion. We must then look for corpuscles in the body, which would explain the threads themselves. And indeed, in Iron-hematoxylin preparations siderophile granules are to be found in a moderate number, close under the pellicula, which might eventually be considered as trichocysts not yet exploded. As for an homology with the trichocysts of Ciliata there can naturally be none. The whole question, especially that of the significance of these elements, needs further study."

I have not been able to detect the presence of these special filaments, yet must confirm the presence of the siderophile granules of which Bêlar speaks, and with which we shall soon have to deal more at length. Before going, however, into that particular subject, I must now consider for a time the second form I spoke of, and which was found at Florissant, Ehrenberg's *Cryptomonas curvata*. The diagnosis, as given by this author, is the following: "Monad with a curved carapace, with a very much compressed body, large, twice as long as broad, $\frac{1}{24}$ millimeter in length, anteriorly and posteriorly curved somewhat in the form of the letter S; color green."

In short, the diagnosis is here nearly exactly the same as that of *Cryptomonas ovata*; the only difference is in the slight S-curve, and one can easily understand the two forms having been united into one, so much the more since *Cr. ovata*, with its special characters not found in *Cr. curvata*, is also sometimes in the form of an S. But there are, really, differentiating characters which we must now examine. The anterior curvature (towards the ventral side), and the posterior (towards the dorsal side) are not of great importance, yet it must be observed that the curvature was present in all the specimens at Florissant, though it was exceptional in the other localities. The ectoplasmic colorless pellicle was thicker, and the small globular bodies (siderophile granules) were more numerous, more distinct also, the chromatophores, curved behind, were more distinctly separated from each other. But there are two more

distinguishing characters, of much greater importance: the layer of starch grains which lies upon the inner surface of the chromatophores in *Cryptomonas ovata* was quite absent in *Cr. curvata*, and the same relations obtained in the case of the two big crystalloid bodies, which never are present in these species; besides, a curious fact was seen in *curvata*: if from the bases of the flagella their line of direction was followed downwards, as far as the middle of the pharyngeal pit, one invariably found there a special granule, very distinct after compression of the animalcule, of a pale bluish hue, and which immediately reddened with borax-carmines, a kinetonucleus, very probably, which could not be detected in *Cr. ovata*.

After these considerations of a systematic nature, I come now back to phenomena which proved common to both species, and which, indeed, were the only inducement to my observing *Cryptomonas* at some length: I mean those sudden leaps or jumps, which have long been known in the genus, and whose explanation has never been given, or at any rate has not been proved.

From time to time, without any apparent reason or on account of some discernible danger, the animalcule suddenly leaps backward, in an amazing jump, five, ten, twenty times its own length, describing an arc or even a nearly complete circle, and always toward the same side, its ventral or concave side facing towards the center of the described arc. When danger grows extreme, and the irritation is at its greatest, the jumps succeed each other without intermission for a few seconds, and at last the little Flagellate falls down exhausted, or sometimes bursts altogether, as if some inside rupture of equilibrium has been produced, which dislocates its different constituents, leaving the animalcule as a shapeless body, with nucleus, starch grains, chromatophores, etc., scattered here and there.

Where are we to find the cause of these sudden jerks, the organ that might produce them? The flagella are out of the question; they are too weak, and besides, those individuals that happen to be deprived of flagella jump just as well as the others. Ehrenberg looks for the explanation in a contraction of the "lateral trunk" the beak-like prolongation, if indeed such is the meaning of the only line he devotes to the subject: "Das rasche Anstossen des seitlichen Rüssels veranlasste offenbar das Hüpfen." But neither beak nor trunk are in the least degree susceptible of any displacement. Another explanation has been proposed, to which Pascher ("Süss-

wasserflora," p. 5) refers: "In some particular groups (*Cryptomonadinae*), springing movements are effected by sudden contractions."

This explanation, which seems to be commonly accepted today, but without anybody trying to prove the fact, has in my opinion hardly any probability. If we take a frog, for instance, and cut its four legs quite close to the body, how can we imagine it to make sudden leaps two and three yards distant, by means of a contraction of its body? Our *Cryptomonas*, after all, very much resembles a frog, and even supposing its whole body to be contractile, it would be difficult to explain in this way even a mere trifling displacement. Such general contractility in *Cryptomonas* is, besides, nothing but a supposition, I don't think any observer ever noticed any contractions, and for my part, I could find no sign of contractility at all. But even supposing the contractility to exist, the solution of the question would not be much advanced, I happened on several occasions to see the animalcule leaping, for one or two seconds at least, when (under the influence of a current of glycerine) the ectoplasmic layers of the body were already crumpled, inert and dead. *Cryptomonas*, in fact, jumps after death.

In short, the contraction theory remains a mere supposition, and I may feel entitled to propose another explanation, which, if not necessarily certain, seems based at least on real phenomena. But before developing the subject, I must state a fact, which does not seem to have been mentioned yet: beside these long leaps backward, other leaps may be seen to occur, even much more frequent, but of much less importance; the body becomes displaced to right or left, forward or backward, by very slight quiverings, and the same appearance is noticed as in Infusoria while they are discharging their trichocysts. Now we have seen that according to the researches of Bêlar and others, the very tiny granules that are found in the periplast of *Cryptomonas* may be considered as trichocysts; in fact, one might compare them also to the "slime trichocysts" which we shall later on speak of in *Trentonia flagellata*; and it can hardly be doubted, I think, that the slight quiverings in *Cryptomonas* are due to superficial trichocysts also.

My supposition, then, could be formulated in the following words: the sudden jumps backward are due to the explosion of big trichocysts, and these are represented by the granules which line the pharyngeal cavity.

There are, of course, several objections against this statement. For instance, after jumping, the animalcule seems not to have suffered any change in the state of the pharyngeal "cage." But that objection is not strong, in fact is perhaps in favor of the theory. After one jump, even two or three, the "cage" looks complete, but it would be practically impossible to detect the loss of one or two granules, and one of them, indeed, on account of its large size compared to one of the small superficial trichocysts, would suffice to cause a leap, its sudden transformation into a considerable mass of some light matter (fine granules, liquid material, slime, or gas?), which would find its way out through the narrowed aperture of the fossa, would certainly cause a violent reaction backward. But though after two or three of these leaps the pharyngeal cage is still intact, it appears, indeed, very different when frequent and violent leaps have rapidly succeeded one another; the cage, then, is seen to be disrupted, the granules, much diminished in number, are scattered in a shapeless mass; sometimes a very few persist, perhaps immature ones, which did not explode. Sometimes, when the animalcule is subjected to the greatest possible excitation, as when a chemical reagent, for instance, comes into play, the jumps rapidly succeed one another without intermission, then the body collapses, bursts, and in the remaining (more or less homogeneous) mass, no trace of the cage is left; as if the granules, not finding a sufficiently wide way of egress, had all exploded inside the body.

A second fact seems to argue for the same theory: the line of the leap, the figure described in space by the displacement of the body. It is always, as we said, an arc, or a circle when the commotion is particularly violent, and always—if I observed well—with the same orientation. Now the pharyngeal pit is narrowed in its anterior part into a tubular passage, somewhat curved towards the ventral side, and on the supposition of a sudden emission of matter through this aperture, the backward jumping must describe a circular figure with the concave side of the body facing towards the center. The very form of *Cryptomonas* might be supposed to necessitate that particular direction, but, as we saw before, *Cryptomonas* may present the most different forms, the smaller individuals being even oval in shape, and yet the jumps never show any difference at all.

But I must now point to a fact, which though appearing at first not to be related to this subject, might on the contrary prove of the greatest importance. At the end of January, 1917, in my col-

lections from Rouelbeau, most of the specimens were found in the state of rest, enclosed in a thick gelatinous envelope, just like a larva in its cocoon.¹⁶ Now, as often as I managed to cause a slight current of carmine-glycerine to come into contact with the cocoon, I could see the animalcules, violently distressed and yet unable to jump, revolve on their longitudinal axis, like a top, and at an extraordinary rate, perhaps twenty turns in a second, the whirling lasted for two or three seconds, and the animalcule collapsed—dead.

The only explanation of these phenomena seems to be, that the animalcule must have been submitted to a violent whirling current, in a circular or spiral direction; and the current could only take its origin from the inside of the cocoon itself, from the discharge, in fact, of some matter which only the animalcule itself could have produced. Now the direction of the tubular opening in *Cryptomonas* is such, that on the supposition of ejected material, there must have been produced the exact whirling current whose effect we have noticed.

As for the composition of the ejected matter, we remain in complete uncertainty. We shall see later on, that in *Trentonia flagellata* the spherules which fill the ectoplasm explode in a finely granular mucilaginous material, easily demonstrated as a white little cloud by using India ink. In *Cryptomonas*, the same result might have been expected, but some experiments with this method have proved fruitless. I distinctly detected, in some particular cases, displacements in the dark mass of infinitely small black grains, and which were certainly not due to oscillations of the flagella (which give quite a different appearance), but no white cloud was formed. The granules did not resolve in these cases into mucilage, but perhaps into very fine granules, mingled with liquid substance, whose effect in India ink would hardly be conspicuous.

Astasia mobilis (Rehberg) Alexieeff. Plate VIII, figures 58–61.

Under the name *Astasia mobilis*, Alexieeff (1) described in 1912 a Flagellate belonging to the group of the Euglenina, and which he had found in the intestine of a *Cyclops*. That Flagellate, however, had already been described by Rehberg in 1880, as *Lagenella mobilis*, but a genus *Lagenella* had been created in 1850 by Schmarda for another organism, and the name had to be abandoned here.

¹⁶ Some of the animalcules, inside the gelatinous pellet, were seen to divide longitudinally; but my observations on the subject are very few, and though confirming in the main those of B  lar on the same subject, would not add any phenomena of importance.

Alexieeff, besides, pointed out that *Astasia* (*Lagenella*) *mobilis* is very nearly related to de Beauchamp's (2) *Astasia captiva*, found in a Rhabdocoele, *Catenula lemnae*, and perhaps might even be the same.

I have met at different times, in the intestine of several species of *Cyclops*—*prasinus* and others much bigger and which were not identified—an *Astasia* which easily corresponds to the two forms, *mobilis* and *captiva*, at least in its general characters, but was mostly of a much larger size. Alexieeff, and de Beauchamp both speak of 30–40 μ , Rehberg indicates 102–103 μ , but in the form I studied, while the very young individuals which we shall soon speak of were within these limits of size, normal adult or old ones, very likely much enlarged by accumulation of food, reached a much greater size, some, which in the spherical state generally shown when first isolated from the host, reached as much as 88 μ in diameter, and after a moment, in their full state of elongation, developed to a length of 300 μ .

Let us now examine one of these large individuals (Plate VIII, fig. 58):

As in all the other species of the group, the organism continually changes in form, its progression being effected by means of swellings and undulations passing from behind forwards. "The metabolic movement," says de Beauchamp, "is perfectly regular; the flow moving from behind forwards, like a large drop which glides along a wire, and there is nearly always a single wave, the posterior end hardly beginning to enlarge by the time the drop reaches the anterior end." These swellings are sometimes so broad, in comparison with the narrow interspaces, that the appearance of the animalcule becomes most singular, like that, for instance, of a tee-totum. The limiting periplast is colorless, thin, but very tough; striated all over with very fine and regular diagonal lines, about $\frac{1}{2}\mu$ distant from each other. The body is nearly always entirely filled with grains of paramylum, in the shape of rectangles, but rounded at the ends, 3, 4, and up to 8 μ in length, greenish-opalescent when examined singly; but when seen as a general mass they have a blackish appearance. These grains represent undoubtedly nutritive reserves, and diminish in size the longer the animalcule fasts. At the posterior extremity, these grains suddenly turn much smaller. In the plasma are also found a considerable number of tiny, shining granulations, colorless, 1 μ in diameter. The nucleus (Plate VIII, figs. 58, 61), lying about in the middle of the body, is spherical, and entirely filled with extremely small granules, which are of variable size according to the individuals. When after compression the very tough nuclear membrane is suddenly rent, there is seen flowing out a large clear area of plasma in which all these tiny gran-

ules are dispersed. These instantly become red when treated with carmine stain. The contractile vacuole is often encircled by a crown of smaller vesicles, which after the systole will fill up the vacuole again. It is at the anterior part of the body, and empties into a large reservoir, which we must consider a little more at length. The fore-part of the body terminates in a slight prominence, a very small point, which itself borders the entrance of a very narrow tubular opening, this tube then plunges straight down, to open into a vast pouch or reservoir. But, from the bottom of the reservoir, or rather a little higher up on one of the sides, are seen arising two very short threads, one of which, the longer, is directed upwards in a diagonal course and reaches up to near the top of the reservoir, whilst the other, much shorter, hardly reaches the middle.¹⁷ These two filaments, which must be considered as two flagella that never extend any higher, each have a basal granule, and the two granules, very near each other, sometimes appear enclosed in a common layer of very pure, bluish plasma. This narrow bluish spot, however, is so indistinct that, doubting its reality, I should not have mentioned it here, if de Beauchamp, with whose observations I only became acquainted long after my own were made, had not said that after the action of reagents he found a small crescent-like black spot upon the wall of the principal vacuole.¹⁸

Such is the structure of the body in these big specimens of *Astasia*. But it may be added, that very large individuals, 80 μ in diameter when in the spherical state, and 300 μ when in full activity, are of exceptional occurrence; they are mostly so large when only one individual inhabits the intestine of the *Cyclops*; more generally there are two, four, eight or more individuals, in which cases they are smaller, and it must be considered as probable that they all came from one specimen, which divided and redivided inside the host. They are, in fact, commonly of the same size in the same *Cyclops* and, if we have in mind the extraordinary differences that are noticed between the individuals one happens to meet with outside the hosts, we cannot but recognize in this special uniformity in size the result of origin from the same parent organism.

¹⁷ The existence of rudimentary flagella does not seem to have been observed. Alexieeff simply says of his *Astasia* that it presents a flagellum or has none; and de Beauchamp that "sometimes a flagellum is present, but in most cases it is impossible to find any trace of one." Neither of these authors, however, has seen anything inside the reservoir, and de Beauchamp speaks of the flagellum as taking its origin—when present at all—from the entrance to the buccal tube.

¹⁸ It is not impossible that Pascher considered de Beauchamp's black spot as a rudimentary stigma, for in the diagnosis of that species he says: "Stigma rudimentary, on the principal vacuole." But de Beauchamp certainly did not see it in this light, as he expressly declares he did not find any trace of a stigma.

Division is very frequent, and it seems curious that neither Alexieff nor de Beauchamp were able to observe it; de Beauchamp states that when outside their host, the animals died in a few hours. Moroff (25), successfully cultivated his *Euglena quartana*, very nearly related to *Astasia*, in an organic medium (pea-soup, etc.), and declares that they thrive in purely inorganic cultures, but that after a very little while they perish.

For my part, I did not find any difficulty in keeping these organisms in very good health for three to five and even six days, after isolation in a drop of clear water on an excavated slide and under protection of a cover.

After creeping for a few hours, one of these big specimens contracts into a perfect spherule, and there lies unchanged, for a variable time, a whole day for instance; but if after having abandoned the animalcule in the evening we examine our slide early next morning, we find then not one spherule but two, sometimes already four, at 10 o'clock in the morning, those four are dividing again, constricted in the middle, at 12 o'clock, eight spherules are present, at 6 o'clock, sixteen are to be seen. On the following morning, the number will be 64, and finally in the evening, after the 8th division, one may count (approximately) as many as 256 small *Astasia*, some contracted, some elongated and lanceolate, many of them creeping or swimming round a lump of mucilaginous material where most of the individuals are still imbedded. Eight divisions have then successively taken place, after which the primitive single individual has been turned into 256 little Flagellates. This number, it must be said, must be considered as a maximum, which I never saw exceeded, but have observed to be reached four times in my eight experiments. At other times, however, long before attaining that number the young animalcules begin to detach from the common mass; we should also note that this mass itself is not always homogeneous, but may be very irregular in appearance. It is not a cyst, in fact, just as the little spherules in the mass are not spores; the jelly is more a fugitive secretion, which is easily destroyed, and perhaps it is only on account of the absolute quiescence after isolation on the excavated slide that the common mass remains compact to the end. But, if we take the mass of jelly and carefully compress it under the cover, these little spherules, born from division and destined to divide again, immediately begin to lengthen, creep about, and change their form, just like adults, and this may be

made to occur at any of the phases of division, the second, third, fourth, etc.

The animalcules of the same generation are all alike, and of the same size but after the third (or fourth?) division, they differ from those which came from the first and second (perhaps also the third) division in an important regard: they have, or they may have, a flagellum.

In one of these small Flagellates, such as was born from the eighth division (Plate VIII, fig. 61), the vermiform body is very clear and still full of paramylum grains, but these are now very small; just at the posterior extremity two or three larger globules are seen (excretion granules), colorless and highly refractive. The hind-part of the body is itself pointed, sometimes drawn out into a glutinous thread-like tail. The nucleus is central, with the characteristic granulations. The contractile vesicle and reservoir are quite as we have already described, and from the bottom of the reservoir are seen to arise two flagella; but while one of these remains in a rudimentary state, just as it was in the big individuals, the other projects through the buccal tube to the outside, rapidly beating, and trailing the animalcule behind. This flagellum, however, is very slender, and comes off on the least excuse; many of the specimens do not have it, either having lost it already or never having possessed it.

According to Moroff (25), in his diagnosis of *Euglena quartana*, a very near relative to *Astasia*, division takes place as follows: "Division after loss of the flagella, either longitudinally into two new individuals, or into four parts after acquiring the globular condition." According to this observer, the second division¹⁹ is at right angles to the first, and seems then to be transverse, the first being longitudinal; but if we keep in mind that all the indications of transverse division in Euglenae have been considered by Klebs and others as very doubtful, we must hesitate in accepting Moroff's statement. It is quite possible that even in the globular condition, after a first division, the two segments insensibly move or displace, and the next division, which is for the observer at right angles to the first, *i. e.*, transverse, is longitudinal in reality. In all circumstances where I could follow the process in its details, the division proved to be longitudinal; and in some individuals, which though already creeping about were yet in a state of division, one could

¹⁹ Moroff never obtained more than two divisions, that is, four young individuals.

foresee that the next division would be longitudinal also, this on account of the nucleus, which begins lengthening at right angles to the longitudinal axis of each of the new individuals, even before the separation of the couple is effected (Plate VIII, fig. 60), and which then will be divided along a line parallel to the line of the next division.

In these young Flagellates, just beginning to divide, the anterior part of the body broadens, and at the same time hollows into a slight concavity, so as to take the form of a heart; the fissure gets deeper and deeper (Plate VIII, fig. 60), and in proportion as it lengthens downward, the lobes of the heart-shaped body become more and more separated, moving in a respectively right and left direction, with the result that at the moment the fissure reaches the end of the body, the lobes, or new individuals, have each of them turned 90 degrees, and lie with their posterior ends united only by a narrow bridge, the ultimate phase of the division, cutting right through the bridge, will then appear to be transverse, while in reality the division has been longitudinal. But this very narrow bridge, which at last consists only of the very tough periplast substance, is not easy to break, the animalcule, or rather now *both*, animalcules, struggle right or left, stretch and retract alternately, and above all, twist and turn on their longitudinal axis as they lie tail to tail; one of them, sometimes, is seen to twist to the left while the other twists to the right (in fact each twists toward its own right side), and at last the separating bridge, very thin and contorted to the utmost, breaks and liberates the two young Flagellates. The little *Astasia* is now free, and creeps or swims about with an activity more remarkable than that observed in the adult condition; no difference, however, is to be seen between those very young individuals and the old ones, except, as already said, in the normal possession of a flagellum.

Speaking of his *Euglena quartana*, a colorless species also, Moroff (25, p. 102) writes as follows: "I succeeded in obtaining individuals which showed with some distinctness a stigma. At the beginning none of the animals showed any trace of such an organ; but after a few weeks I was able to obtain some, in which the eye was apparent as a very small yellow spot, later on it had acquired an orange hue and looked larger, but later still the eye remained in the same condition, without my obtaining any further results."

Astasia mobilis never shows any stigma, yet I found once, not in a *Cyclops* but in a watch-glass where some *Cyclops* had been

isolated, an *Astasia* (or *Euglena*?) seeming identical, at first sight, with the habitual parasite, but its paramylum grains were of a more distinctly greenish hue, and besides a small red stigma could be detected distinctly. On another occasion, I got from the intestine of a *Cyclops* an *Astasia* in which *two* small red eyes existed, one to the right and the other to the left on the anterior part of the body. This specimen, it must be added, was relatively broad and short, and perhaps not far from dividing.

That these two individuals belonged to *Astasia mobilis* is not certain. Alexieeff observes that in the *Euglena* group "transitional forms are found which lead from facultative to definitive parasitisms." Must *Astasia mobilis* be considered as a *Euglena* whose evolution terminated in parasitism, and in which individuals may be found, which retain some ancestral characters?

***Euglena pseudomermis* sp. n.** Plate VIII, figures 62, 63.

This elegant little *Euglena*, which looks at first sight so much like a Nematode that one sometimes mistakes it for one, was found in two different localities, Pinchat and Rouelbeau, in every season of the year but always very rare.

The form is that of a needle (Plate VIII, fig. 62),²⁰ very straight, 165 to 190 μ in length for only 7½ to 8 μ in breadth, and it is quite near the anterior part of the body, on a level with the contractile vesicle, that the maximal breadth is found; from this region it diminishes in width by insensible gradation to the posterior extremity, whose thinness is quite extraordinary. Owing to a slight lateral compression, a transverse section of the needle would give a broadly elliptical figure. Seen along the narrower of the sides, it shows a characteristic swelling (Plate VIII, fig. 62), coinciding with the dilatation of the internal reservoir. The periplast looks shining and smooth, but in reality proves longitudinally striated, but the striae are so delicate and thin that only in very favorable conditions can their reality be ascertained. At the anterior end (Plate VIII, fig. 63), which is somewhat expanded, and in optical section appears to be provided with two tips, the periplast curves and invaginates towards the interior, but for a short distance only, and from this point is continued as a simply plasmatic film which lines the reservoir.

This characteristic pouch or reservoir, very long, broad and rounded at the base, becomes narrower towards the top, and at last joins the buccal opening. Into the hind part of the reservoir, and on one of its sides, empties at regular times the contractile vacuole, which is sometimes surrounded by very small accessory vesicles. A short flagellum is seen arising from the buccal funnel,

²⁰ In the figure, the animalcule is represented too broad relatively to its length.

a little behind the opening; it looks as if held in place by a basal granule, and at the same time appears to be lengthened posteriorly, like a hardly visible tracing, until it reaches a very distinct swelling about level with the middle of the reservoir. This swelling is caused by the presence, just outside the wall of the reservoir, of a large and very distinct globule, or kintonucleus. Opposite the kintonucleus, and on the other side of the reservoir, is the stigma, of a delicate brick-red tint; its form is that of a saucer, and seen from the side looks like a crescent whose convexity is turned towards the reservoir. Viewed from the dorsal side, it is seen to be a small roundish spot. In the immediate vicinity are sometimes seen very small red particles, which later on will join the principal mass. The internal protoplasm, very clear, and with myriads of extremely fine granules, is in its major portion occupied by a more or less considerable number of rod-like elements, which look like chromatophores, but without color. These are needle-shaped, of a very pure opalescent hue, generally 25 to 30 μ in length for only 2 or 3 μ in breadth, and often even much thinner, especially those which fill the posterior end of the body. They are set longitudinally, imbricating upon each other, and lie along the whole length of the body. They seem, in fact, to take the place of absent chromatophores, and if we keep in mind the statements of several observers that green chromatophores are susceptible, under certain influences,²¹ of being reduced to the state of leucoplasts, it seems that in our *Euglena pseudomermis* also we are entitled to think of the structures as leucoplasts rather than as paramylum bodies or any other sort of pyrenoid. We might then consider this species as one of those very rare green Flagellates, which have lost their colored constituents, but which still keep the stigma, but only as a vestige of a preceding state.

Is this species, although deprived of true chromatophores, still absolutely holophytic, or would it to a certain extent take food from the outside in the form of microbes or particles of some other form? I have found in several instances small vegetal particles in the reservoir, and also inside the body protoplasm some small vacuoles have been met with, which contained little granules, like food-vacuoles in fact, but the explanation might be different, and the subject remains still obscure.

About in the middle of the body is seen the nucleus, whose appearance is most peculiar. It is generally found as a spherule, surrounded by a clear halo of lighter material, but this nucleus proper

²¹ Light would be the more important agent. According to Zumstein (1900) the chromatophores disappear as such in the dark, but persist as leucoplasts, and reform into chloroplasts again if brought back into the light. *Euglena pseudomermis* was always collected with a small net dipped into the black mud of the bottom of the ditch; it is quite possible that it lives in semi-darkness inside that "organic felt" which is found carpeting the ground.

is itself a constituent part of a long, pale, grayish rod-like mass, which stains red with carmine, but much less easily than does the spherical nucleus. Sometimes, there are two of these cylindrical masses, with the nucleus in one of them only; or the cylindrical mass may contain, not one nucleus in its center (as is most generally the case, (Plate VIII, fig. 63), but several, regularly disposed, for instance three at equal distances, or four in two groups which are separated by a longer interval (Plate VIII, fig. 62).

Euglena pseudomermis slowly progresses forward in a straight line, then suddenly stops, and takes up its course again, slightly shaken by the beating of the flagellum. The little moving needle looks rigid, not deformable, but is not so in fact; from time to time it is seen to curve feebly, or become deformed by longitudinal undulations, very weak indeed but adding in a remarkable manner to the resemblance to a small Nematode.

The only two *Euglenae* which I could find in literature to have any similarity to *Euglena pseudomermis* are *Eugl. acus* Ehrenberg and *Eugl. acutissima* Lemmermann. But both are relatively much less lengthened, fusiform rather than like real needles; and besides, they have characteristic green chromatophores. I long hesitated as to the genus to which this little Flagellate might belong. *Menoidium* differs from *Euglena* in the complete absence of chromatophores. Would it have been better to make a *Menoidium* of this species?

Trentonia flagellata Stokes. Plate VIII, figs. 64–67 a, b.

In the analytical table which concerns the group of the *Chloromonadinae*, as given by Pascher (27, p. 177), the subdivision of the colored forms is into three genera, which are distinguished from each other as follows:

- I. No highly refractive trichocyst-like corpuscles in the peripheral plasma layer.
 - A. Cells changeable in form, more or less pyriform, narrower at the anterior end. *Vacuolaria*.
 - B. Cells less changeable in form; at the anterior end diagonally truncate, long and narrowed posteriorly. *Trentonia*.
- II. In the peripheral plasma, highly refracting trichocyst-like corpuscles. *Gonyostomum*.

Vacuolaria would then differ from *Trentonia* only in having a more pronounced change of form, and also by some difference in shape, the narrower part being anterior whilst in *Trentonia* it is

posterior. As far as I could observe, there is no importance in the first of these distinctive characters, the changes of form in *Trentonia* being much greater than is generally thought, and as for the general shape of the body, if Cienkowsky's *Vacuolaria virescens* proves to be in accordance with the above-mentioned diagnosis, Senn's *Vacuolaria viridis*, which according to Pascher is intermediary between *Trentonia* and *Vacuolaria*, is in fact like *Trentonia* being described as inversely pyriform (verkehrt birnförmig), rapidly narrowed at the tail-like posterior end, strongly broadened and excavated anteriorly. On the same page 177, Pascher adds a note: "We must probably reunite with *Vacuolaria* Stein's *Coelomonas*, which differs from the former only in the possession of a single flagellum. The second flagellum, which lies very close to the body, probably escaped Stein's attention."

As for *Gonyostomum*, or more especially Diesing's *Gonyostomum semen* which is synonymous with Ehrenberg's *Rhaphidomonas semen*, it is nothing but a *Trentonia* again, but one in which are found, under the periplast, small highly refracting rod-like bodies which at times develop as cilia. Speaking of *Rhaphidomonas*, S. Kent (20) writes as follows: "Excepting for the presence of numerous and variously distributed trichocysts it closely resembles *Coelomonas*," and Stokes (34) says of his *Trentonia flagellata*: "This is very similar to *Rhaphidomonas semen* (Ehrbg.) Stein, with two flagella and no apparent trichocysts. When first observed it was without hesitation identified with the above-mentioned European form." In the classical treatise of Engler & Prantl (12), one reads, page 171, concerning *Coelomonas*: "Doubtful genus. Like *Vacuolaria*, but with only one flagellum. Stein has probably missed the second flagellum. . . . The genus *Coelomonas* Stein must also very likely be abandoned."

Between all these Flagellates, *Vacuolaria viridis*, *Coelomonas grandis*, *Trentonia flagellata*, and even *Gonyostomum semen*, the differences are so obscure, the general form of the body, the triangular reservoir, the chromatophores—everything, in fact, is so identical, that it is difficult to fancy anything but one and the same organism; in *Coelomonas*, the second flagellum, which in *Trentonia* is at the very limit of visibility, might not have been detected; in *Rhaphidomonas*, the trichocysts have been exaggerated in their appearance. However it may be, it is as *Trentonia flagellata* Stokes (33), undoubtedly identical with what I have seen myself, that I shall consider the curious Flagellate we now come to speak of. It

was found, rather numerous, in two different localities: Pinchat, where I found it in every season of the year, and Rouelbeau, where it was seen on one occasion only.

The most striking quality of this Flagellate is perhaps found in its special coloration, a beautiful bright green, which invests the whole body, and at once distinguishes it from the many other colored organisms that are swimming about. It is the pure green of chlorophyll, such as is found in the spherical granules of the higher plants, being without admixture of blue or brown.

The body (Plate VIII, fig. 64), measuring 40, 50, and up to 60 μ and more, is in the form of a fish, two to three times as long as broad, somewhat compressed laterally, broader at the anterior end, narrower posteriorly, and often terminating in a point. The form of the whole body is slightly changeable, subject to alteration here or there, becoming now and then contorted or even excavated, but coming after a time to its original shape. The little green organism goes straight on its way, with a single flagellum visible, which is thin and straight, about as long as the body, and which hardly seems to move. From time to time, a sudden advance or leap is noticed, somewhat as in *Cryptomonas* but to a much shorter distance, and not always backwards but forwards just as well. To get an adequate understanding of the intimate structure of *Trentonia*, it is necessary to have recourse to compression, gentle, weak enough not to deform the body to more than a moderate degree, and yet strong enough to stop its movements (Plate VIII, fig. 65). The result required is, however, easily obtained, as the periplast is absent (or rather represented by a very thin hardened pellicula) and nothing prevents the body expanding. The body, in fact, may be considered as naked, so much so that with a stronger compression the animalcule is seen to transform into the shape of an *Amoeba*, displaying lobes or even extending into pseudopodia. Inside the very thin surface pellicle is a rather thick layer of very pure ectoplasm, of a peculiar appearance, opalescent and shining, and in it are seen dispersed a number of very small light vesicle, or vacuoles, which seem to be provided with a distinct wall. But in that external opalescent layer other elements are found, tiny spherical granules, very clear and brilliant, which often are seen to protrude over the surface of the pellicula, sometimes even in the shape of short setae.²² They must probably be considered as trichocysts, the very structures which are represented by Stein in *Rhaphidomonas semen* as rod-like in form, but in the present species globular. Inside this ectoplasmic layer are the chromato-

²² In an animalcule that had been much compressed, along its longitudinal axis (Plate VIII, fig. 66), without any addition of a reagent, the whole surface was seen surrounded by very short radial filaments, which must have resulted from the exploding of these tiny bodies.

phores. They consist entirely of small fusiform bodies, regularly disposed in two or three superimposed layers, with their long axes in a line parallel to the surface of the body. They are very delicate, and when compressed become rounded, showing at the same time a central lighter region. All together, these fusiform corpuscles make up a thick envelope, limiting a large clearer endoplasm, colorless, half-liquid in appearance, which contains the nucleus. This latter, very pale, consists of a homogeneous grayish plasma, with here and there a few very small nucleoles. At the anterior end of this colorless endoplasm, a large triangular space appears, the characteristic reservoir, into which from time to time is seen to empty the adjacent contractile vesicle; the reservoir itself communicates with the outside by means of a narrow channel, which opens not quite at the anterior extremity, but somewhat laterally.

Of the two flagella, only one of them, the locomotor flagellum, can usually be detected. Both, however, have their origin in the small depression where the channel of the reservoir opens, and, so far as I could observe, start from the same spot, a little within the opening and on the ventral side of the tube. Stokes describes the locomotor flagellum as "apparently originating in the oval fossa; the other taking its origin on the ventral or lower surface a short distance behind the anterior extremity, and usually trailing, but I should not be surprised if there was a mistake in this statement. Further on the American observer continues: "The trailing flagellum is ordinarily extremely difficult to see. When the Infusorian is rendered uncomfortable and sluggish by prolonged confinement beneath the cover, or partially poisoned by iodine, then the vibratile flagellum, which is usually held stiffly in advance, the tip alone trembling, is flashed into sight as a rapidly undulating spiral, and the trailing appendage is also momentarily directed forward. . . . It is scarcely possible to believe that Stein would have failed to notice so important an appendage." My own observations entirely confirm Stokes's statements; but as for a mistake by Stein, I regard it indeed as quite possible. The trailing flagellum is so extraordinarily thin, and its refracting properties are so much like that of water, that it is only detected with the utmost difficulty. I studied *Trentonia* for many days without noticing any second flagellum, which, however, was there; afterwards, I was able to see it on many occasions. Some of my observations seem to prove that when the animalcule is at rest, the accessory flagellum lies stretched behind, and adheres with its tip to the substratum, keeping the body in place.

When describing the thick layer of opalescent ectoplasm which surrounds the body, I mentioned but two kinds of included elements, the tiny trichocysts and the small round vesicles; but we must now consider a new sort of inclusions. They are spherules, 2μ in diameter, of a very pale and pure bluish hue, and though extremely numerous, generally escape any notice, or rather are ascertained only after compression of the body; and the greater the compression the more numerous they are seen to be, they are in such numbers, in fact, that they seem to make up the whole of the plasma.

Singly examined (Plate VIII, fig. 67*a*), they are seen to possess a distinct membrane, very thin and smooth but suddenly, after a few seconds of observation, the membrane happens to burst, and through the opening expands a voluminous mass of mucilaginous material, mingled with a number of extraordinarily fine dust-like particles (Plate VIII, fig. 67). These globules, in fact, must be considered as quite a special form of trichocysts, the "Schleimtrichocysten" of German authors. But during all the time that the gradual compression of the animalcule is continued, there are seen to take place inside the compressed plasma small commotions, sudden disturbances of equilibrium, explanation of which is difficult to determine; but if India ink is used, the most external of the spherules, which are easily examined singly, are seen to eject a little white cloud when bursting, at the same time that a slight commotion is noticed in the adjacent lining ectoplasm; all these successive commotions that we saw occurring inside the animalcule must then also have their cause in exploding internal trichocysts.

India ink experiments enable us to observe still more curious phenomena: if the black current is made to touch an animalcule which is in perfect health, and is moving freely under the cover glass, the organism is seen to throw out here and there, now backwards, now forwards, or on one side, these same white little clouds which we observed before, and at each of these characteristic explosions, the animalcule leaps backward or forward or to one side. It is, indeed, a very interesting thing to follow one of these little animals while swimming at full speed, discharging without intermission its projectiles, like a man-of-war that would bombard the

enemy. To these successive explosions we must attribute the characteristic leaps in *Trentonia*.²³

I must mention, before concluding, the existence of gelatinous cysts, which I found numerous at Pinchat, in the month of May. They are very similar to those of *Cryptomonas ovata*, and contain either one single individual, or very often two, longitudinally applied to each other, undoubtedly a result of division. Sometimes, instead of two individuals, four are found, or two couples, one to the right and the other to the left inside the gelatinous cyst, which would certainly indicate a second division.

BIBLIOGRAPHY.

1. ALEXIEFF, A. Le Parasitisme des Eugléniens et la Phylogénie des Sporozoaires. Arch. de Zool. expér. et gén. Notes et revue, Sér. 5, tom. 10. 1912.
2. BEAUCHAMP, P. de. *Astasia captiva* n. sp., Euglénien parasite de *Catenula lemnæ*. Ibid., Notes et revue, tom. 6. 1911.
3. BLOCHMANN, F. Zur Kenntniss von *Dimorpha mutans*. Biol. Centralbl., Bd. 14. 1894.
4. BELAR, K. Protozoenstudien—II. Arch. f. Protistenk., Bd. 36. 1916.
5. BERLINER, E. Flagellaten-Studien. Ibid., Bd. 15. 1909.
6. BURCK, C. Studien über einige Choanoflagellaten. Ibid., Bd. 16. 1909.
7. BUTSCHLI, O. Mastigophoren. In Bronn's Thierreich. Bd. 1. 1883.
8. CONRAD, W. Contributions à l'étude des Flagellates. Arch. f. Protistenk. Bd. 34. 1914.
9. DELAGE ET HEROUARD. Traité de Zoologie concrète. Tom. 1. La Cellule et les Protozoaires. 1896.
10. DUNKERLY, J. S. Flagellata and Ciliata, Clare Island Survey. In Proceed. Royal Irish Acad., parts 61-62. 1913.
11. EHRENBURG. Infusionsthierehen als vollkommene Organismen. Berlin, 1838.
12. ENGLER AND PRANTL. Natürliche Pflanzenfamilien. Bd. 2. 1900.
13. FRANZA, C. La flagellose des Euphorbes. Arch. f. Protistenk. Bd. 34. 1914.
14. GRUBER, A. *Dimorpha mutans*, eine Mischform von Flagellaten und Heliozoon. Zeitsch. f. wiss. Zool. Bd. 36. 1881.
15. HARTMAN AND JOLLOS. Die Flagellatenordnung Binucleata. Arch. f. Protistenk. Bd. 19. 1910.
16. HARTOG, M. The Cambridge Natural History. Vol. 1. Flagellata. 1906.
17. HOFENEDER, H. Ueber eine neue Koloniebildende Chrysomonadine. Arch. f. Protistenk. Bd. 29. 1913.
18. IMHOF, O. E. Das Flagellatengenuss *Dinobryon*. Zool. Anzeiger. Bd. 13. 1890.
19. IWANOFF, L. Beitrag zur Kenntniss der Morphologie und Systematik der Chrysomonaden. Bullet. de l'Acad. imp. des Sci. de St. Pétersbourg. Sér. 5, tom. 41. 1899.
20. KENT, S. A Manual of the Infusoria. 1880-82.
21. KLEBS, G. Flagellaten-Studien—I, II. Zeitsch. f. wiss. Zool. Bd. 55. 1892.
22. LANG, A. Handbuch der Morphologie der wirbellosen Thiere. 3e. Aufl. 1913.

²³ When discussing *Cryptomonas ovata*, we had recourse to the trichocyst theory for explaining the sudden backward jumps, and the facts here obtained may be of considerable value as indicating greater probability in the former suggestion.

23. LAUTERBORN, R. Protozoenstudien—IV. Flagellaten aus dem Gebiete des Oberheims. Zeitsch. f. wiss. Zool. Bd. 65. 1899.
24. LEMMERMANN, E. Notizen über einige Flagellaten. Arch. f. Hydrobiol. d Planktonkunde. Bd. 8. 1912-13.
25. MOROFF, T. Beitrag zur Kenntniss einiger Flagellaten. Arch. f. Protistenk. Bd. 3. 1903.
26. PASCHER, A. Rhizopoden und Palmellastadien bei Flagellaten. Ibid. Bd. 25. 1912.
27. PASCHER, A. Süßwasserflora Deutschlands, Oesterreichs und der Schweiz. Jena, 1913-14.
28. PENARD, E. Ueber einige neue oder wenig bekannte Protozoen. Jahrb. Nassauischer Vereins f. Naturkunde. Bd. 43. 1890.
29. SCHERFFEL, A. Kleiner Beitrag zur Phylogenie einiger Gruppen niederer Organismen. Botan. Zeitung. 1901.
30. SCHERFFEL, A. Beitrag zur Kenntniss der Chrysomonadinen. Arch. f. Protistenk. Bd. 22. 1911.
31. SCHOUTEDEN, H. Notes sur quelques Flagellées. Ibid. . Bd. 9. 1907.
32. STEIN, F. von. Organismus der Infusionsthier. 1878.
33. STOKES, A. A preliminary contribution toward a history of the freshwater Infusoria of the United States. Journ. of the Trenton Nat. Hist. Soc. Vol. I. 1888.
34. STOKES, A. Notices of new freshwater Infusoria. Proceed. of the Amer. Philos. Soc. Vol. 28. 1890.
35. VOIGT, M. Beiträge zur Kenntniss des Planktons Pommerscher Seen, Th. IV. Forschungsber. Plön. Th. 9. 1902.

EXPLANATION OF PLATES V, VI, VII, VIII.

PLATE V.—Figs. 1-3.—*Pteridomonas scherffeli*.

1. Normal aspect; at the left side, captured food; at the lower end, the posterior crown of pearls.
2. Another specimen, with some "flagellopodia" vibrating.
3. Another, in course of division.

[NOTE—The flagella of the above figures have been strengthened slightly to insure reproduction.—EDITOR.]

Figs. 4-6.—*Dimorpha tetramastix*.

4. Heliozoan state.
5. Flagellate state.
6. Flagellate state, with some trailing pseudopodia.

Figs. 7-8.—*Dimorpha monomastix*.

7. Heliozoan state.
8. Flagellate state.

Figs. 9-13.—*Bicoeca exilis*.

9. Typical appearance.
10. Another individual, seen from the side.
11. Disposition of the flagellum in the enrolled state.
12. An animalcule retracted in the capsule, and about to throw off its flagellum.
13. Swimming form.

PLATE VI.—Figs. 14-19.—*Histiona campanula*.

14. Typical form.
15. Another specimen, seen from another viewpoint.
16. Extremity of the trunk-like appendage.
17. Swimming form, with anterior flagellum undulating.
18. Another individual, with posterior flagellum vibrating.
19. An animalcule in successive stages of the act of attaching after swimming.

Figs. 20-28.—*Salpingoeca polygonatum*.

20. Normal aspect.
21. Division, nearly completed.
22. The flagellated animalcule, as it comes from division.

23. An animalcule swelling up to construct the capsule.
24. *a* to *g*, a young individual, resting on the mucilaginous substratum, then straightening, pushing down a pedicle and beginning the construction of the capsule.
25. *a*, unequal division; *b*, the small flagellate which comes from the unequal division.
26. Encystment; the cyst is complete, except at the anterior extremity, where the protoplasmic collar and the flagellum are seen expanded.
27. Another cyst, entirely closed.
28. Another form of encystment, in a balloon-like capsule.

PLATE VI.—Figs. 29–33.—*Salpingoeca lepidula*.

29. Typical form.
30. Division; the young animalcule sliding down the old capsule.
31. The same animalcule, $\frac{1}{2}$ minute later; nearly reaching the substratum.
32. A young animalcule attaching.
33. Construction of the capsule; above to the left is shown a large microbe which fell upon the neck, then slowly glided along the ectoplasm and stopped opposite the contractile vacuole.

PLATE VII.—Figs. 34–40.—*Salpingoeca lepidula*.

34. Swimming form of the animalcule, after abandoning the capsule.
35. An individual completing the construction of the capsule; the primitive fixation thread is still to be seen.
36. An animalcule, whose ectoplasm is expanding in filamentous pseudopodia.
37. Thickening of the protoplasmic collar, by means of intruding ectoplasmic material.
38. The same, a few minutes later.
39. Another specimen, with ectoplasmic material climbing up along both the collar and the flagellum.
40. An individual with a sheet of ectoplasm, climbing up along the inner surface of the collar.

Figs. 41–44.—*Chrysamoeba radians*.

41. The *Amoeba* state.
42. A flagellate, about to revert to the *Amoeba* state.
43. Flagellate state.
44. Division. In *a*, the division is as yet but little advanced; the two V-shaped chromatophores, together forming a *W*, are seen in the middle; to the left, a large mass of leucosine. In *b*, the body has lengthened; in *c*, it begins to be distinctly narrower in the middle; the leucosine mass has lengthened; the large vacuole is larger still; in *d*, the leucosine body is already rod-like in form; in *e*, the large vacuole has burst. In *e*, the separation is nearly effected; half of the leucosine body passes to each of the new individuals. In *f*, the new individuals are separated.

Figs. 45–49.—*Chrysopyxis bipes*.

45. Normal appearance.
46. Special form, without tubular opening; the body is in process of division; one pseudopod only, down which microbes are gliding.
47. An animalcule about to leave the capsule.
48. The same, swimming about after leaving the capsule.
49. No tubular opening. At the base of the pseudopodia, an accumulation of microbes, about to disappear into the common trunk.

PLATE VIII.—Figs. 50–54.—*Hyalobryon ramosum*.

50. Normal aspect of the animalcule, with its caudal adhesive filament (which is represented too short, as well as the enveloping tube also).
51. A bunch of empty tubes, straight.
52. A bunch of empty tubes, contorted.
53. Tubes in a fascicle, attached to a diatom.
54. Several tubes inserted one within the other.

Figs. 55-57.—*Cryptomonas ovata*.

55. Normal appearance, with starch grains lining the chromatophores, and on the left the characteristic crystalloid bodies.

56. A very young specimen, ovate.

57. The "*curvata*" form, without starch or crystalloid bodies; on the right, near the pharyngeal fossa, is the kintonucleus.

Figs. 58-61.—*Astasia mobilis*.

58. One of the large specimens. At the anterior end, the reservoir, with the two rudimentary flagella, and beside it, the contractile vacuole.

59. Nucleus.

60. Division.

61. A very young, flagellated individual.

Figs. 62, 63.—*Euglena pseudomermis*.

62. The animalcule seen from the side (represented too broad, relatively to the length).

63. Details of the anterior portion. Reservoir and kintonucleus; to the right, the stigma; lower down, the contractile vesicle. Inside the plasma, leucoplasts, and the nucleus with its two cylindrical prolongations.

Figs. 64-67.—*Trentonia flagellata*.

64. Normal appearance.

65. Compressed body.

66. An animalcule, which was compressed along the longitudinal axis, showing radial setae (exploded trichocysts).

67, *a*. A mucilage-bearing spherule, in a small protoplasmic vesicle.

67, *b*. Exploded spherule, with a mucilaginous granular cloud.

DESILICATED GRANITIC PEGMATITES¹.

BY SAMUEL G. GORDON.

The granitic pegmatites are among the most interesting mineral assemblages known to the mineralogist, containing as they frequently do so many rare minerals. The present paper describes an abnormal group of granitic pegmatites, composed either of plagioclase, usually albite, alone (albitite); of plagioclase and corundum (plumasite); or largely of corundum; all of which occur exclusively in peridotites or their altered equivalents. The conclusion has been reached that they owe their peculiarities to the reactions which occurred between the original pegmatitic solutions and the peridotite or serpentine into which these solutions were intruded. Such an origin has been demonstrated for the plumasite of South Africa by Du Toit²; a study of the albitites of Pennsylvania and Maryland indicates a similar genetic history; and the corundum deposits of Pelham and Chester, Massachusetts, of western North Carolina, and of Georgia present analogies which show them to belong in this group.

PREVIOUS WORK.

Albitite.

CALIFORNIA: The name albitite was given by Turner³ in 1896 to an albite rock occurring as dikes in serpentine in the Grizzly Hill area, about Meadow Valley, and near Big Bar Hill, Plumas County, California. The albitite dikes were composed of large grains of albite with marked cleavage, and showing occasionally a twin lamella.

Previous to this, Palache⁴ had described a soda amphibole (cros-

¹ The writer is indebted to Dr. Edgar T. Wherry and Dr. N. L. Bowen for a critical examination of this paper. The Pennsylvania and Maryland albitite were studied during the summer of 1920. An account of the minerals of the district will appear shortly in *The American Mineralogist*, and a description of the chromite deposits in a later paper in the *PROCEEDINGS* of this Academy.

² *Trans. Geol. Soc. S. Africa*, 21: 53-73, 1919 (see abstract below).

³ *Am. Geol.* 17: 375-388, 1896; *Fourteenth Ann. Rep. U. S. Geol. Surv.*, 1892-93, (1894) 477; *U. S. Geol. Surv. Folio* 43, 1898.

⁴ Charles Palache, *Univ. of Calif. Publ., Dept. Geol., Bull.* 1: 181-192, 1894.

site) from a large boulder of white saccharoidal albite which was found in the bed of a stream at the foot of the Sierras near Berkeley. The boulder contained also veins of actinolite.

FRANCE: In 1900, Lacroix noted the occurrence of albitite dikes in the peridotites of Bellongue (Ariège), France, consisting essentially of albite-oligoclase.⁵

URAL MOUNTAINS: Duparc and Pamfil have described albitite from Koswinsky, in the northern Ural Mountains, where it forms aplitic dikes in dunite.⁶ As in the case of the California and French occurrences no data was given as to the relation of the albitite to the country rock, beyond the fact that it formed intrusives in serpentine or peridotite.

The Russian albitite is associated with a series of related rocks which have been named granulite, gladkaite and plagiaplite.

The granulite is a rock composed essentially of quartz, andesine, and biotite, forming veins in the dunite of Koswinsky.

Gladkaite is a fine grained aplite composed of oligoclase and andesine, with much quartz, some hornblende and biotite, and secondary muscovite and epidote. It forms dikes in the dunite at Gladkai Sopka, and Kamenouchky.

Plagiaplite is an equigranular aplite composed of oligoclase or andesine, with variable amounts of quartz and hornblende, and subordinate muscovite or biotite. This rock forms dikes in the pyroxenites of Koswinsky and Kamenouchky.

This series may represent granitic pegmatites which differ in the degree of desilication which they have undergone. Analyses of them are given by Duparc and Pamfil.

The occurrence of albitic dikes in the serpentines of New South Wales was noted by Benson⁷ who considered them as being genetically related to the peridotites.

Plumasite.

CALIFORNIA: The name plumasite was given by Lawson to an oligoclase-corundum rock forming a fifteen foot dike in a serpentinized peridotite on the lower flank of Spanish Peak, Bidwell Bar quadrangle, Plumas County, California.⁸

⁵ Alfred Lacroix, *Comptes Rendus du VIII Congrès International de Géologie*, 1900: 806-838, Paris, 1901.

⁶ *Bull. Soc. Franc. Min.*, 33: 347-375, 1910.

⁷ *Proc. Linn. Soc. New South Wales*, 38: 691, 1913; *Am. J. Sci.*, (4) 46: 715, 1918.

The plumasite is a coarse allotriomorphic granular aggregate of white oligoclase ($\text{Ab}_{85}\text{An}_{15}$) in which are imbedded pale violet blue idiomorphic crystals of corundum. Scaly films of margarite occur in fractures in the corundum. One hundred feet northwest of the corundiferous portion of the dike, the rock consists of coarse granular plagioclase without corundum, but with occasional nests of a grayish-green fibrous monoclinic amphibole. Twenty-five feet southeast of the corundiferous portion, the dike consists of microcrystalline and porphyritic andesine. An analysis of the oligoclase is given below.

ITALY: In 1903, Lacroix⁹ called attention to the occurrence of plumasite near Mosso Santa Maria, Biella, Italy, from which Gonnard¹⁰ had described corundum crystals. An analysis of the oligoclase is given below.

NEW CALEDONIA: Subsequently, Romeu¹¹ noted the occurrence of plumasite in New Caledonia.

TRANSVAAL: The Transvaal corundum deposits have been described by Wagner.¹² South Africa is the leading corundum-producing country at present, the greater part coming from the Zoutspansberg and Pietersburg districts of the Transvaal. Most of the corundum recovered occurs as alluvial crystals or fragments and boulders. The source of the material was found to be a plumasite composed essentially of andesine, ($\text{Ab}_{85}\text{An}_{15}$), greenish biotite and corundum. The corundum occurs in crystals up to 6 inches in length scattered through the plumasite, which, however, may consist wholly of andesine.

NATAL: In 1919, Du Toit¹³ described the plumasite of Natal, with details concerning its relation to the country rock, and mode of origin.

The Natal plumasite forms dikes in the serpentine bodies of the Tugela Valley. The area is underlain by hornblende-schists, granulites, and basic gneisses, riddled with dikes and veins of pegmatite and aplite. In this complex are sills of serpentine, a light gray to dark green fine grained rock composed almost entirely of antigorite, with occasional plates of talc and black particles of

⁹ Univ. of Calif. Publ., Dept. Geol., Bull. 3: 219-229, 1903.

¹⁰ Bull. Soc. Franc. Min., 26: 147-150, 1903.

¹¹ Bull. Soc. Franc. Min., 20: 177-181, 1897.

¹² Bull. Mus. d'Hist. Nat., 12: 594-596, 1906.

¹³ Trans. Geol. Soc. S. Africa, 21: 37-42, 1919.

¹⁴ Trans. Geol. Soc. S. Africa, 21: 53-73, 1919.

magnetite and chromite. Microscopic study indicates that the original rock was a saxonite composed of predominant enstatite or bronzite.

The plumasite dikes are very irregular in thickness and direction, and are composed of white granular oligoclase on the margins; towards the center corundum makes its appearance with silvery white margarite; in places corundum and margarite may occur to the exclusion of the oligoclase. The composition of the plumasite veins varies considerably, in some places being entirely feldspathic, and elsewhere quite rich in corundum. The oligoclase forms granular aggregates, only one third of which exhibits repeated twinning, although the bulk of the remainder possesses a higher index of refraction than balsam. The corundum forms dark gray, grayish green or bluish crystals, which are frequently sheathed by a thin shell of primary margarite. At times secondary margarite penetrates the basal cleavage plates of the corundum, or forms margaritized individuals with remnants of corundum.

The most interesting plumasite dike pierced a large sill of serpentine flanked below by granulite which was exposed through a vertical range of 150 feet. In the granulite the dike was a normal granitic pegmatite composed of quartz, orthoclase, and subordinate plagioclase, with hardly any biotite, and no corundum. In the serpentine above the dike had contracted in width, lost all its quartz, but now carried corundum.

Du Toit advanced the view that the plumasite owes its genesis to the desilicating action of the serpentine walls upon the originally acid magma constituting the dike. Evidence of reaction between the invading acid magma and its ultrabasic walls is quite evident. Between the plumasite and the serpentine is a contact zone from a few feet to 10 feet in width. Adjacent to the plumasite the zone consists of a belt of brown mica, variable in width, which passes laterally into a proportionally wider belt of massive or foliated talc. The mica is brownish, with weak to moderate pleochroism, and an axial angle of 2° to 20° or 30° , and considered to consist of both biotite and phlogopite.¹⁴ Irregular or lenticular patches of the mica occur as xenoliths in the plumasite. Isolated patches of the talc may occur in the serpentine. In the reaction between the pegmatitic solutions and the serpentine the serpentine received an addition of silica, alumina, potash and fluorine to form the

¹⁴ More probably vermiculite.

zones of biotite and talc, resulting in the impoverishment of these constituents in the dike which crystallized into an aggregate of oligoclase, corundum, and margarite, with occasional tourmaline.

TABLE I. ANALYSIS OF OLIIOGLASE.

	A	B
SiO ₂	61.36	62.76
Al ₂ O ₃	22.97	21.95
CaO.....	5.38	2.68
Na ₂ O.....	8.08	10.31
K ₂ O.....	...	1.08
H ₂ O.....	1.72	0.29
	99.51	99.07
Sp. gr.....	2.633	2.628

A. *Oligoclase*, Spanish Peak, Plumas County, Calif.; Lawson, loc. cit., analysis by J. Newfield.

B. *Oligoclase*, Mosso Santa Maria, Biella, Italy; A. Cossa.¹⁵

PENNSYLVANIA AND MARYLAND ALBITITES.

Albitite has long been quarried for feldspar in the serpentine area along the Pennsylvania-Maryland line, which includes southern Lancaster and Chester counties, Pennsylvania, and Cecil County, Maryland.

The geology of part of the district has been described by Bascom,¹⁶ and the principal quarries by Hopkins¹⁷ and Bastin.¹⁸

The district is underlain by an igneous complex, to the north of which lies a mica gneiss thoroughly injected by a fine grained granite. The igneous rocks form a batholithic mass, in which the following interesting series is exhibited in passing from the southeast to the northwestern part of the district: biotite granodiorite, hornblende granodiorite, quartz-biotite-hornblende gabbro, quartz-hornblende gabbro, hornblende-norite and quartz-norite, norite, pyroxenite, and peridotite. All are more or less metamorphosed, the granodiorites assuming a gneissic structure, while the peridotite is usually altered to serpentine.

The more important albitite dikes are limited to the largest serpentine mass which lies along the Pennsylvania-Maryland line

¹⁵ A. Cossa. Ricerche chimice e microscopiche su rocce e minerali d'Italia, Feldispathe corindonifero della Biellese. Torino, 1881, 65.

¹⁶ Maryland Geolog. Survey, Cecil County, 83-148, 1902.

¹⁷ Ann. Rep. Penna. State College, 1898-99: 7-20.

¹⁸ U. S. Geol. Surv. Bull. 420: 63-77, 1910.



Fig. 1.—Albitite quarries of the Havre de Grace quadrangle, Lancaster and Chester Counties, Penna., and Cecil Co., Md. The heavy black lines mark the boundaries of the principal meta-peridotite (serpentine) areas, to the north of which lie mica schists. The areas are bounded on the south by norite.



Fig. 2.—Albitite and plumasite occurrences of the West Chester quadrangle, Chester County, Penna. B, Brinton's serpentine quarry, containing veins of albitite; Co. abandoned corundum mines in plumasite near Unionville.

(fig. 1). Small irregular dikes occur also in Brinton's serpentine quarries, three miles south of West Chester (fig. 2). Extensive quarries lie west and northwest of Sylmar in Chester County, and southeast of Rock Springs, and northeast of Pilot, Cecil County. In two cases, east of Bald Friar, and a mile northeast of Pilot, Cecil County, quarries have produced commercially both albite and talc. But two quarries are at present worked: Wiant's quarry three-quarters of a mile northeast of Pilot, and Garrison's quarry, three-quarters of a mile east of Rock Springs, Cecil County. The others are abandoned and filled with water, but their size gives evidence of the great quantity of albite which they formerly produced.

The albitite dikes range in size from a few inches in width, such as at Brinton's quarry, south of West Chester (fig. 2), to great masses four or five hundred feet in length, and more than a hundred feet in width, such as were quarried at the Rock Springs quarry, and at the Sparvetta, Keystone, and Brandywine quarries, one and a half miles west of Sylmar, and at Campbell's quarry, two miles northwest of Sylmar.

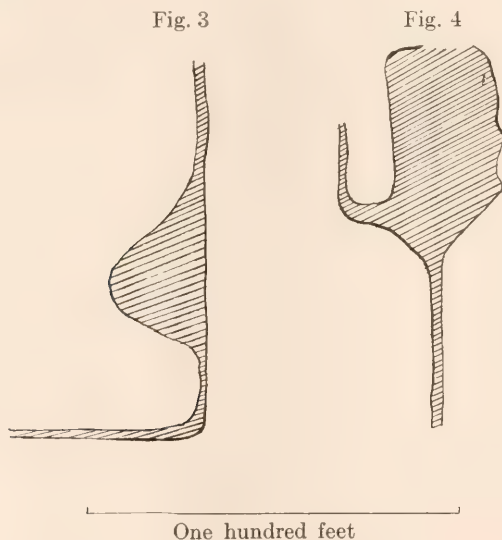


Fig. 3.—Horizontal section of an albitite dike quarried one and a quarter miles northwest of Sylmar, Chester County, Pennsylvania.

Fig. 4.—Horizontal section of an albitite dike quarried two miles northwest of Sylmar.

As is characteristic of pegmatites in general, the albitite dikes are exceedingly irregular, pinching and swelling, and very frequently bifurcating. Examples of the irregularities are shown in fig. 3 and fig. 4.

The albitites consist almost entirely of granular white, yellowish, or bluish gray, translucent albite.¹⁹ Most of the albite is untwinned,—a peculiarity noted above as being shown by the albite of the California albitite, and in the oligoclase of the Natal plumasite. A yellowish-white untwinned albite from Campbell's quarry, two miles northwest of Sylmar gave the following indices of refraction upon immersion, indicating a quite pure albite: $\alpha = 1.526$, $\beta = 1.530$, $\gamma = 1.536$, $\text{all} = 0.0005$. A granular grayish white albite from the vicinity of the Line Pit (probably from the present site of Garrison's quarry, three-quarters of a mile west of Rock Springs) was analyzed by Brush²⁰ with the following results:

TABLE 2. ANALYSIS OF ALBITE.

Granular, grayish-white; near the Lancaster County chrome mines. Analysis by Brush.

SiO ₂	66.65
Al ₂ O ₃	20.79
MgO.....	0.52
CaO.....	2.05
Na ₂ O.....	9.36
	99.37
Sp. gr.....	2.619

Quartz is conspicuous by its absence, having been noted at but one locality, a quarry north of Black Run, one and a half miles northwest of Sylmar, where it occurs with much muscovite and anorthoclase (fig. 7). The most frequent accessory minerals are hornblende and biotite. Hornblende forms minute radiating groups while biotite occurs in minute crystals, scattered through the albite, at times occurring locally in large amount. Tourmaline is abundant in the albitite of Brinton's quarry, and molybdenite has been found in the quarries northwest of Sylmar. Actinolite sometimes occurs in beautiful greenish radiations through the albite, especially near the margins of the dikes. The albitite of Wiant's quarry, three-quarters of a mile northeast of Pilot, Cecil County, is filled with miarolitic cavities which are lined with minute, color-

¹⁹ Called "leelite" in some of the earlier lists of Pennsylvania minerals.

²⁰ Am. J. Sci. (2), 8: 390, 1849.



Fig. 5

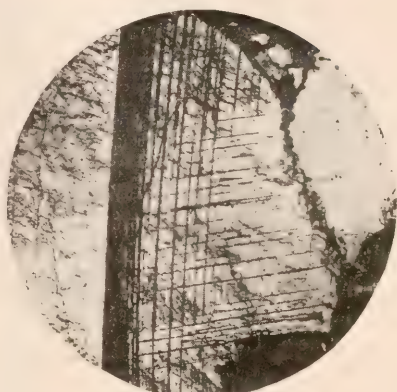


Fig. 6

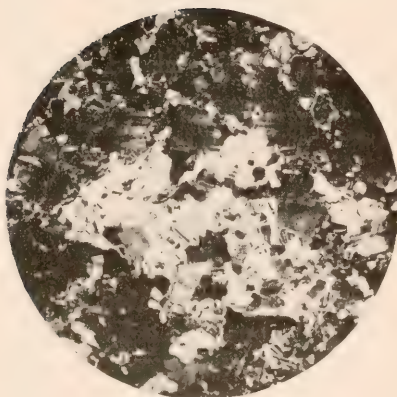


Fig. 7

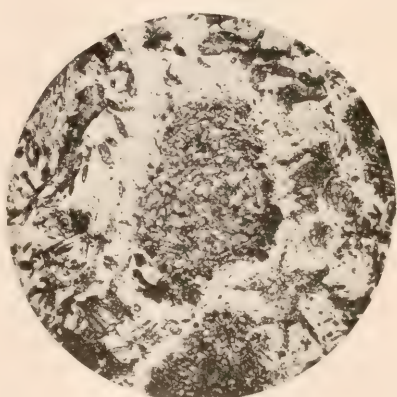


Fig. 8

Fig. 5.—Albite, Garrison's quarry, west of Rock Springs, Cecil County, Maryland. Crossed nicols, x 15.

Fig. 6.—Albite, showing both albite and pericline twinning. One mile southwest of Nottingham, Chester County. Crossed nicols, x 15.

Fig. 7.—Albite (black), anorthoclase (twinned), and quartz (white), one and a half miles northwest of Sylmar, Chester County, Penna. Crossed nicols, x 15.

Fig. 8.—Aggregates of zoisite (gray in center), in serpentine (white groundmass) through which are dispersed needles and blades of actinolite (dark). One and a half miles northwest of Sylmar. Plain light, x 15.

less albite crystals. Minute, transparent, greenish, highly modified beryl crystals occur rarely implanted on the albite, while not infrequently the rest of the cavity is filled with matted masses of dark greenish actinolite needles. Occasionally a peculiar green and white porphyritic rock occurs near the margin of the dikes, especially in the Sylmar district. Examination of thin sections of of this material shows the phenocrysts to be aggregates of zoisite in a groundmass of serpentine, and actinolite needles, (fig. 8). Such an association in which the zoisite was pink in color has been briefly described by Wherry.²¹

Adjacent to the albitite dikes are usually three distinct zones of minerals formed by the reaction of the pegmatitic solutions with the serpentine walls. In passing from the albitite to the serpentine their order is: vermiculite, actinolite with more or less talc, and talc—beyond which lies the serpentine (fig. 9).

The vermiculite zone consists of brown scaly vermiculite, representing a weathered biotite. Analyses of the variety jefferisite from Brinton's quarry, Chester county, are given below. Masses of vermiculite may occur in the albitite. The actinolite zone, which is thinner than others, consists of greenish radiating crystals of actinolite with more or less talc. The talc zone consists of silvery white to light greenish, massive or foliated talc, in which are usually disseminated many minute octahedral crystals of magnetite.

It will be observed that there is a gradual increase of magnesia and water in passing from the albitite to the serpentine. From this it seems probable that the peridotite had been serpentinized prior to the intrusion of the albitite, which had the effect of partially dehydrating the serpentine in the vicinity of the intruded mass. In the formation of the biotite (now vermiculite), actinolite, and talc zones, the pegmatitic solutions were more or less depleted of silica, alumina, lime, potash, and fluorine. The potash, fluorine, and alumina went to form the biotite zone, magnesia and perhaps iron being furnished by the serpentine. Most of the silica was used in silicating the serpentine to actinolite and talc, the physico-chemical conditions being such as to cause the formation of hydroxy-silicates. The result was that the original pegmatitic solutions, which under normal circumstances would have crystallized into a rock composed of quartz, microcline, albite or oligoclase, muscovite

²¹ Edgar T. Wherry, Some Minerals from Sylmar, Pennsylvania, *Am. Min.*, 3: 47, 1918.

and biotite, lost practically everything but the constituents of albite, and consequently solidified to a rock consisting almost wholly of this mineral.

Sp	T	A	V	Ab	V	A	T	Sp
----	---	---	---	----	---	---	---	----

Fig. 9.—Generalized diagram of the contact phenomena shown by the Pennsylvania and Maryland albitite dikes. Ab = albite; V = vermiculite (altered biotite); A = actinolite, with more or less talc; T = talc; Sp = serpentine.

TABLE 3. ANALYSIS OF JEFFERISITE, BRINTON'S QUARRY, CHESTER COUNTY, Pa.

A. Clarke and Schneider;²² B. Koenig;²³ C. Chatard.²⁴ An earlier but erroneous analysis by Brush is omitted.²⁵

	A	B	C
SiO ₂	34.20	33.35	34.40
Al ₂ O ₃	16.58	17.78	16.63
Fe ₂ O ₃	7.41	7.32	8.00
FeO.....	1.13	2.11	(2.11) ²⁴
MgO.....	20.41	19.26	19.30
H ₂ O.....	21.14	19.87	19.03
	100.87	99.69	99.47

²² Am. J. Sci. (3), 40: 452, 1890.

²³ Proc. Am. Phil. Soc., 13: 392, 1873.

²⁴ Am. J. Sci. (2), 31: 370, 1861. Previous to this the mineral had been known to collectors under the name of phlogopite.

²⁵ Taken from Koenig's determination.



Fig. 10.—Albitite and plumasite occurrences of the Chester quadrangle, Delaware County, Penna. A, Albitite occurrences; Co, abandoned corundum mines in plumasite.

PENNSYLVANIA PLUMASITES.²⁶

Plumasites or corundum-bearing pegmatites occur in Pennsylvania at the following localities: Morgan Station and Black Horse in Delaware County, (fig. 10), and near Unionville, Chester County (fig. 2). All form intrusive masses in serpentine, or at the contact of serpentine and gneiss.

The geology of the region has been described by Rogers,²⁷ Frazer and Hall,²⁸ Rand,²⁹ Bascom³⁰ and others. The area is underlain by Precambrian gneisses and schists into which have been intruded bodies of granite, gabbro, peridotite and pyroxenite. The basal or Baltimore gneiss is a banded quartz-feldspar rock with massive granitic facies. Overlying this is the Wissahickon mica gneiss, a schistose quartz-feldspar rock with an excess of biotite or muscovite. The peridotites and pyroxenites, which are genetically related to the gabbros, in most cases have been hydrated to serpentine.

MORGAN STATION (VILLAGE GREEN.) This locality is situated on a very small patch of serpentine intrusive in Wissahickon gneiss one-quarter mile south of Morgan Station, Aston township (fig. 10). Large bronzy brown corundum crystals were found sheathed with white pearly margarite.³¹

BLACK HORSE, MIDDLETOWN TOWNSHIP. An old corundum mine was formerly situated in a large area of serpentine about one-quarter mile south of Black Horse, on the west side of the road to Elwyn (fig. 10). Many loose crystals of corundum were found in the soil in the vicinity of the pit, and elsewhere in the township. One half mile to the west are exposed granite gneisses. The corundum in slender bipyramidal crystals, of a white to brown color, often asteriated,³² was found in a granular white albite-oligoclase.

²⁶ As it has been stated that corundum was first found in America in Laurens County, S. C., in 1819, it is desirable to point out an earlier discovery of this mineral at Chestnut Hill, Philadelphia: Adam Seybert, *Adamantine spar and basaltes*, Medical Repository, 3: 202, 1800; also J. C. Delam  therie, *J. de Phys.* (53), 9: 404-405, 1801.

²⁷ Henry D. Rogers, *Geology of Pennsylvania*, 1858.

²⁸ Second Geological Survey of Penna., Reports C4 and C5, 1883 and 1885.

²⁹ *Proc. Acad. Nat. Sci., Phila.*, 1900: 160-338.

³⁰ *Bull. Geol. Soc. America*, 16: 289-328, 1905; *U. S. Geol. Surv. Folio* 162, 1909.

³¹ *Am. J. Sci.* (2), 379-380, 1849.

³² *Proc. Am. Phil. Soc.*, 13: 361-406, 1873; *Ibid.*, 20: 381-404, 1882; Joseph Willcox, *Second Geol. Surv. Penna.*, Rep. C4: 346-354, 1883.

UNIONVILLE, CHESTER COUNTY.³³ The Unionville corundum mines, now abandoned, are situated in Newlin township, respectively one and a half and two miles northeast of Unionville (fig. 2), at the contact of serpentine and mica gneiss. Many boulders of corundum were obtained in the fields by the farmers who systematically dropped a crow-bar in the soil in the trail of the plow.

At the pits one and a half miles northeast of Unionville the corundum was found in a rock consisting of granular white albite, corundum, black tourmaline, margarite, and euphyllite—a basic sodium and potassium mica. The corundum occurred in white or grayish crystals. Zoisite was abundant, and occasionally black octahedra of spinel were obtained. Adjacent to the vein the following minerals were noted: talc in white foliated masses and greenish actinolite with much dark green chlorite.

At the mine one-half mile north of the preceding one a vein of corundum and margarite seven feet thick was uncovered, which was separated from the serpentine by a zone of foliated talc. In this a vein of fawn-colored diaspore measuring three by two feet in length and width, and two inches in thickness was discovered, some of the crystals of which were two inches long.³⁴ The corundum was white, brownish gray, to bluish. Crystals not infrequently were sheathed with margarite or damourite. Margarite formed in yellowish or pinkish foliated masses, or secondary aggregates of scales with cores of corundum. Associated with the margarite were honey-yellow or fawn colored laminated masses of diaspore, occasionally in perfect spendent crystals up to two inches in length. Beautiful translucent bluish or greenish prismatic crystals of tourmaline penetrate the diaspore. The association is such as to indicate the order of crystallization: tourmaline, diaspore, margarite. Jefferisite (vermiculite) is found in large yellowish green plates.

The plagioclase at the Unionville mines varies from white albite to yellowish striated oligoclase. Analyses of these are given below.

³³ H. D. Rogers, *Geology of Pennsylvania*, I, 1858, 170. Joseph Willcox, *Sec. Geol. Surv. Penna. Rep.*, C4: 346, 1883. Joseph Leidy, *Proc. Acad. Nat. Sci. Phila.*, 1872: 238–239. Frederick A. Genth, *Proc. Am. Phil. Soc.*, 13: 361–406, 1873; 20: 381–404, 1882. The statement “about one mile from Unionville on the Kennett Square road” means from the upper mine, and not the village of Unionville.

³⁴ Isaac Lea, *Proc. Acad. Nat. Sci. Phila.*, 19: 44–45, 1867.

TABLE 3. ANALYSES OF ALBITE AND OLIGOCLASE, UNIONVILLE, CHESTER COUNTY, PA.

A. Albite, white; mean of two analyses. J. L. Smith and George J. Brush, *Am. J. Sci.* (2), 15: 211, 1853.

B. Albite, white, crystalline. Martin H. Boye, *Proc. Am. Phil. Soc.* 2: 150, 1841.

C. Albite, white, crystalline; analysis by Weld. Benjamin Silliman, Jr., *Am. J. Sci.* (2), 8: 377-394, 1849.

D. Oliogoclase, brownish-white; analysis by Thomas M. Chatard. Frederick A. Genth, *Proc. Am. Phil. Soc.*, 13: 361-406, 1873.

	A	B	C	D
SiO ₂	64.27	67.72	66.86	59.35
Al ₂ O ₃	21.21	20.54	21.89	24.16
Fe ₂ O ₃	tr.	tr.	....	0.61
MgO.....	0.58	0.34	0.48	0.34
CaO.....	0.81	0.78	1.78	3.08
Na ₂ O.....	10.94	10.65	8.78	7.22
K ₂ O.....	1.36	0.16	....	3.78
Ignition.....	1.08	....	0.48	1.96
	100.25	100.19	100.27	100.50
Sp. gr.....	2.61	2.612		

LOCALITIES OF PLUMASITE IN OTHER STATES.

PELHAM, MASSACHUSETTS: The occurrence of corundum and its associated minerals at Pelham, Mass. has been described by Emerson.³⁵ The locality is an asbestos mine, one mile southwest of Mount Lincoln, Pelham township, where a great block of black saxonite is enclosed in Pelham granite gneiss.

The saxonite is a fine granular dark gray rock composed of colorless enstatite darkened by abundant chromite and magnetite, and containing porphyritic plates of bronzy enstatite. Between the Pelham granite gneiss and the saxonite a thick contact "reaction rim" has been developed. The granite gneiss is a light gray rock consisting of a granular mixture of quartz, microcline, streaked with biotite scales and epidote grains. Near the contact the granite is more massive, less biotitic and quartzose, and grades into a layer of snow-white, fine grained anorthite containing some andesine crystals, and much disseminated tourmaline, rutile, zircon, and allanite. This layer passes into an interrupted layer of black massive tourmaline in many places two feet thick, at times containing some large imperfect crystals of the mineral, with small

³⁵ U. S. Geol. Surv. Monograph, 29: 47-55, 1898; U. S. Geol. Surv. Bull., 597, 215-216, 1917. See also Earl V. Shannon, *Am. Min.*, 4: 37-39, 1919.

crystals of apatite and zoisite. The last zone is composed of coarsely matted reddish-brown biotite from four inches to four feet thick containing many nodules of dark green fibrous actinolite and large nodules and crystals of corundum. Beyond this lies the saxonite which for a distance of three to twelve feet contains a network of veins of colorless, fibrous anthophyllite,—the asbestos for which the pit was worked.

The tourmaline, rutile, and allanite are characteristic of pegmatitic assemblages, and in this case a pegmatitic facies probably developed at the margin of the Pelham granite gneiss which reacted with the saxonite to form the interesting series of contact minerals. Beyond the contact zones siliceous solutions entered the fractured saxonite and silicated the saxonite minerals to anthophyllite.

CHESTER, MASSACHUSETTS: The Chester emery deposits have been described by Jackson,³⁶ Shepard,³⁷ and Emerson.³⁸ The Chester emery deposits occur as a series of small disconnected lenses up to sixteen feet in thickness, but averaging four feet, between the Chester hornblende schist and serpentine. The hornblende schist is a dark-green to black foliated or ligniform epidotic quartz-hornblende schist considered by Emerson to be of sedimentary origin. The hornblende schist is bordered at several places with lenticular intrusive masses of serpentine.

The emery vein consists of a mixture of chlorite and magnetite containing in abundance bronze colored crystals of corundum, and a considerable quantity of tourmaline in black crystals or stellated aggregates. In passing from the hornblende schist to the serpentine the following sequence is noted: hornblende schist, biotite layer, chloritic band with tourmaline, emery vein with various minerals, corundophilite zone, talc zone, and finally serpentine. The corundophilite zone may be wholly replaced by a white to reddish, fine grained saccharoidal oligoclase up to twelve inches in thickness.

One of the most interesting sections is that of the mine at the base of South Mountain. The serpentine on the east passes into a zone of pure, light-green, schistose or massive talc, through which are scattered remnants of serpentine from which the talc was derived. The width of this zone varied from five to fifteen feet.

³⁶ Am. J. Sci. (2) 39: 87, 1865.

³⁷ Charles U. Shepard, A description of the emery mine of Chester, Hampden County, Mass., London, 1865.

³⁸ U. S. Geol. Surv. Bull., 597: 159-161, 1917.

See also Earl V. Shannon, Am. Min., 4: 69-72, 1919.

Beyond this is the corundophilite zone³⁹ composed of plates of corundophilite 20 mm. broad, which may be wholly replaced by oligoclase. The corundophilite often penetrates the emery vein in sheets filling fissures, on which may occur in cavities fine foliated sheets of pearly margarite, and thick masses of interlaced blades and crystals of violet diaspore, frequently enclosing bright red needles of rutile, or broad plates of ilmenite.³⁹ Rarely associated with these are radiating yellowish green needles of epidote, or brown crystals of brookite. To a much later period of mineralization belong veins of specular hematite in small rosettes, pyrite, chalcopyrite, calcite, and aragonite.

It will be seen that the mineralogy of this deposit is quite complex. However, the presence of such minerals as tourmaline, oligoclase, rutile, brookite, etc., the evidence of reaction with the serpentine, and the features resembling the plumasites described above, all indicate that this deposit probably owes its origin largely to the desilication of a granitic pegmatite intruded along the contact of the hornblende schist and serpentine.

GEORGIA: The Georgia corundum deposits have been described by Francis P. King.⁴⁰ All of the deposits occur in ultrabasic rocks forming intrusive masses in the gneisses and schists. The veins vary in form, and are from one to twelve feet in width. The following four types were recognized by King: (a) lime-soda feldspar with quartz and phlogopite or vermiculite, (b) lime-soda feldspar with actinolite; (c) a coarse-grained aggregate of lime-soda feldspar, black hornblende, and margarite; (d) a massive vein made up of light grass-green amphibole ("smaragdite"), lime-soda feldspar, and a little chromite. All these types have walls of compact, scaly chlorite, which quite frequently contains corundum. The second type (b) is rare, and the corundum crystals usually possess a sheathing of secondary margarite. The third type (c) is more common than (b), but it differs from the first two in its massive, pegmatitic character. The fourth type (d) is very rare, being known only at the Bell Creek mine, Towns County, and in Clay County, North Carolina. The rock is made up of a beautiful grass-green bladed smaragdite, and feldspar, through which are scattered pink and ruby-red corundum.

At the Hog Creek mine, Town's County, a boulder of zoisite en-

³⁹ Known to the old miners as the "fringe rock."

⁴⁰ Francis P. King, Geological Survey of Georgia, Bull., 2, 1894.

cased in finely fibrous actinolite was found. The most important mine, however, was that at Laurel Creek, Rabun County, which occurred near the contact of peridotite and gneiss.

NORTH CAROLINA: The corundum deposits of North Carolina have been described in detail by Joseph Hyde Pratt and J. Volney Lewis.⁴¹ They occur largely in areas of peridotites and pyroxenites intrusive in the gneisses and schists in the mountain belt extending from Georgia through Clay, Macon, Transylvania, Jackson, Haywood, Buncombe, Madison, Yancey, and Mitchell Counties. The peridotites are usually dunite or saxonite, but secondary serpentine, talc, chlorite, and amphibole schists occur.

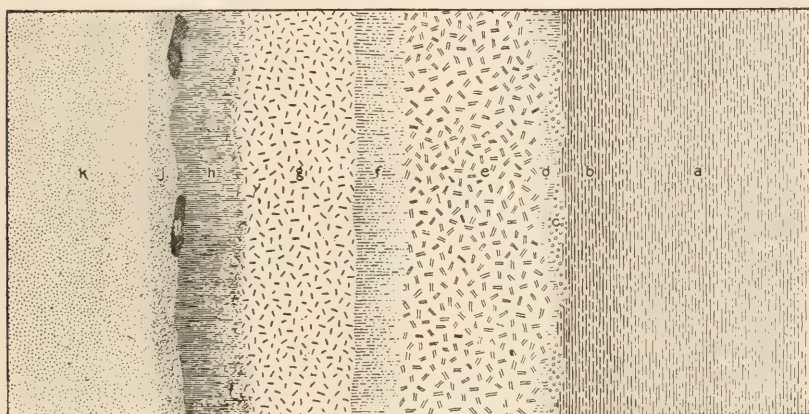


Fig. 11.—Ideal section of a border vein of corundum at the Corundum Hill mine, Macon County, N. C. (Pratt and Lewis); (a) gneiss, hornblende or micaceous, unaltered; (b) gneiss, decomposed; (c) yellowish vermiculites, often merging into (d), and sometimes absent; (d) green chlorites of varying thickness; (e) the corundum vein consisting of chlorite and corundum, often with some vermiculites; (f) green chlorites; (g) enstatite, in places hard and compact, usually merging into (h); (h) talcose rock, usually fibrous; (i) a seam of yellowish clay often carrying masses of quartz and chalcedony, sometimes absent; (j) more or less altered dunite; (k) fresh dunite. An important variation is the development of a zone of corundum-bearing plagioclase either in the corundum-bearing zone of chlorites or vermiculites (e) or entirely replacing this zone.

Two types of corundum veins were recognized by Pratt and Lewis: the peripheral or border veins at the contact of peridotite and gneiss, and interior veins which occurred wholly within the peri-

⁴¹ J. Volney Lewis, N. C. Geol. Surv. Bull., 11, 1896. Joseph Hyde Pratt, U. S. Geol. Surv. Bull., 180, 1901; and 269, 1906. Joseph Hyde Pratt and J. Volney Lewis, North Carolina Geol. Surv. 1, 1905. Am. J. Sci. (4) 8: 227-231, 1899.

dotite. In all cases interesting series of contact zones are exhibited (figs. 11 to 13).

Important deposits were worked in Clay County near Elf on Shooting Creek, on Chunk Gal Mountain, and at Buck Creek. At the Buck Creek or Cullakenee mine, the corundum occurred as grayish-white, bluish, or pink crystals with a deep green smaragdite, and a white granular plagioclase, ranging in composition from andesine to anorthite. Associated with these were grayish columnar masses of zoisite, and lamellar crystals of margarite. Analyses of the plagioclase are given below.

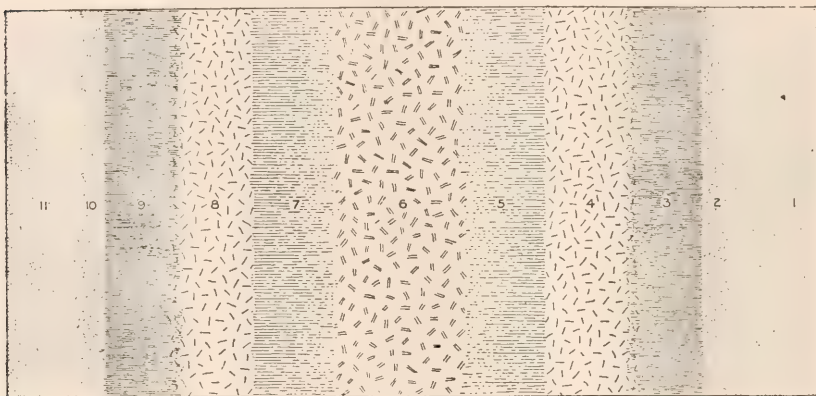


Fig. 12.—Ideal cross-section of an interior vein of corundum at the Corundum Hill mine, Macon County, N. C. (Pratt and Lewis); (1 and 11) normal dunite; (2 and 10) somewhat friable and discolored dunite; (3 and 9) fibrous talc; (4 and 8) grayish, somewhat fibrous, enstatite; (5 and 7) green chlorites; (6) central corundum-bearing zone consisting of chlorites, corundum, and spinel. An important variation is the development of a zone of corundum-bearing plagioclase either in zone (6) or entirely replacing it.

At this mine two zeolites, wellsite and chabazite, were found in veins in the feldspar.

One of the most important mines was the Corundum Hill or Cullasaja mine, seven miles northeast of Franklin, Macon County. The veins were of both the border and interior types (figs. 11 and 12). An analysis of oligoclase from this locality is given below. In addition, large masses of black tourmaline containing corundum were found, and very rarely margarite, and minute crystals of diaspore.

At the Cowee Valley, Macon County, small ruby crystals have been found enclosing rhodolite, a garnet of the composition: $3\text{Mg}_3\text{Al}_2(\text{SiO}_4)_3:\text{Fe}_3\text{Al}_2(\text{SiO}_4)_3$.

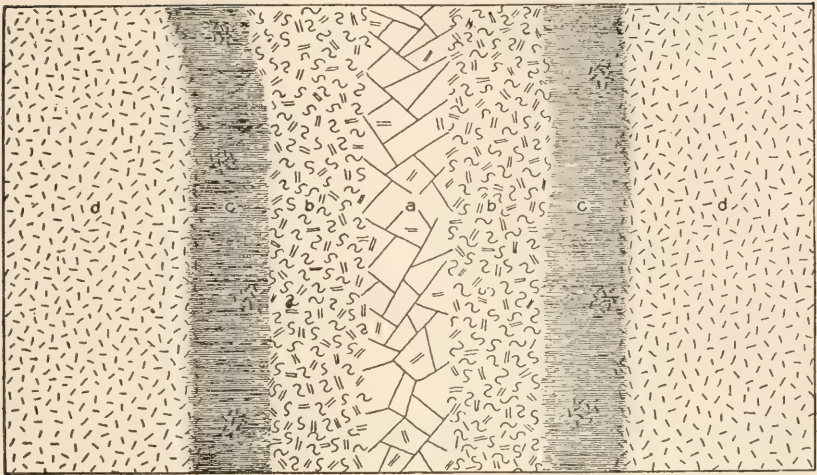


Fig. 13.—Ideal vertical section of corundum in amphibolite at Hunters, Iredell County, N. C. (Pratt and Lewis); (a) a feldspar vein more or less altered to kaolin and often bearing corundum; (b) vermiculite zones carrying corundum; (c) radiating sheaths of actinolite enclosing some amphibolite; (d) amphibolite often reduced to a mass of ocherous clay containing needles of hornblende and scales of vermiculite.

TABLE 5. ANALYSES OF THE PLAGIOCLASE FELDSPARS OF THE NORTH CAROLINA CORUNDUM VEINS.

A. Oligoclase, Corundum Hill mine, Macon County, N. C. H. M. Keller, U. S. Geol. Surv. Bull., 74, p. 55.
B. Andesine. Buck Creek mine, Clay County, N. C. Snow-white to bluish-white masses, striated. G. A. Koenig, Proc. Am. Phil. Soc., 13: 375, 1873.
C. Andesine. Buck Creek mine, Clay County, N. C. T. M. Chatard, Proc. Am. Phil. Soc., 13: 375, 1873.
D. Labradorite. Buck Creek mine, Clay County, N. C. White lustrous cleavage masses. W. H. Jarden, Bull. U. S. Geol. Surv., 74, p. 54.

	A	B	C	D
SiO ₂	63.32	57.29	58.41	55.61
Al ₂ O ₃	35.19	26.52	25.93	26.90
Fe ₂ O ₃.....	....	0.21	0.38	....
MgO.....	....	0.15	0.18	....
CaO.....	5.01	7.80	5.82	9.60
Na ₂ O.....	8.02	6.75	6.45	6.97
K ₂ O.....	0.25	0.33	2.10	0.55
Ignition.....	....	1.43	0.93	0.35
	101.79	100.48	100.20	99.98
Sp. gr.....	....	2.611	2.610	....

The origin of the North Carolina deposits has been a much discussed question. The contact zones were described early by Shepard,⁴² Chatard,⁴³ and others.

Julien,⁴⁴ although regarding the dunite beds as metamorphosed sediments, believed that the veins originated by the introduction of deep seated solutions of soda and alumina into fissures during the period of metamorphism.

Chatard pointed out the progressive increase in magnesia as the dunite is approached and a gradual decrease in the amount of alumina. He regarded the corundum veins as the result of alterations along the contact of aluminous-alkaline silicate rocks and magnesian-silicate rocks, probably effected by surface solutions.

Because of the circumstance that many of the corundum deposits occurred at the margins of peridotite masses, Pratt and Lewis⁴⁵ presented the theory of their origin as magmatic segregations of a peridotite magma. It was believed that the corundum was held in solution in the molten peridotite when it was intruded, and that the corundum was among the first minerals to crystallize out. This solidification would take place first at the outer border of the mass where it cooled first. Convection currents would tend to bring a new supply of material carrying alumina to this outer zone where it would crystallize.

Holland⁴⁶, and Teall⁴⁷, presented objections to this theory based on the rather old experiments of Morozewicz⁴⁸, which indicated that in a magma supersaturated with silica, that is, one in which the molecular ratio of Al_2O_3 to the bases CaO , K_2O , and Na_2O is more than 1:1, the excess of silica would separate out as corundum if MgO and FeO were absent and SiO_2 were not present in an amount sufficient to form sillimanite. With the presence of MgO and FeO spinel would form, or if enough silica were present iolite (cordierite).

More recently the ternary system $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2$ was studied in detail by Rankin and Merwin.⁴⁹ The results of their precise

⁴² Am. J. Sci. (3) 4: 109-114, 175-180, 1872.

⁴³ U. S. Geol. Surv. Bull., 42: 45-63, 1888.

⁴⁴ Proc. Boston Soc. Nat. Hist., 22: 141-149, 1882.

⁴⁵ Loc. cit.

⁴⁶ Mem. Geol. Surv. India, 30: 209, 1901.

⁴⁷ Proc. Geol. Assoc., 16: 72, 1899.

⁴⁸ Tschermak's Min. u. Petr. Mitth., 18: 1-90, 105-240, 1899.

⁴⁹ Am. J. Sci., (4) 45: 301-325, 1918. See also Olaf Andersen, Ibid., 39: 407-454, 1915.

work indicate that corundum would not be expected as an early phase in the crystallization of a dry magma near peridotite in composition. It is clear that evidence of magmatic segregations of corundum in ultrabasic rocks is lacking.

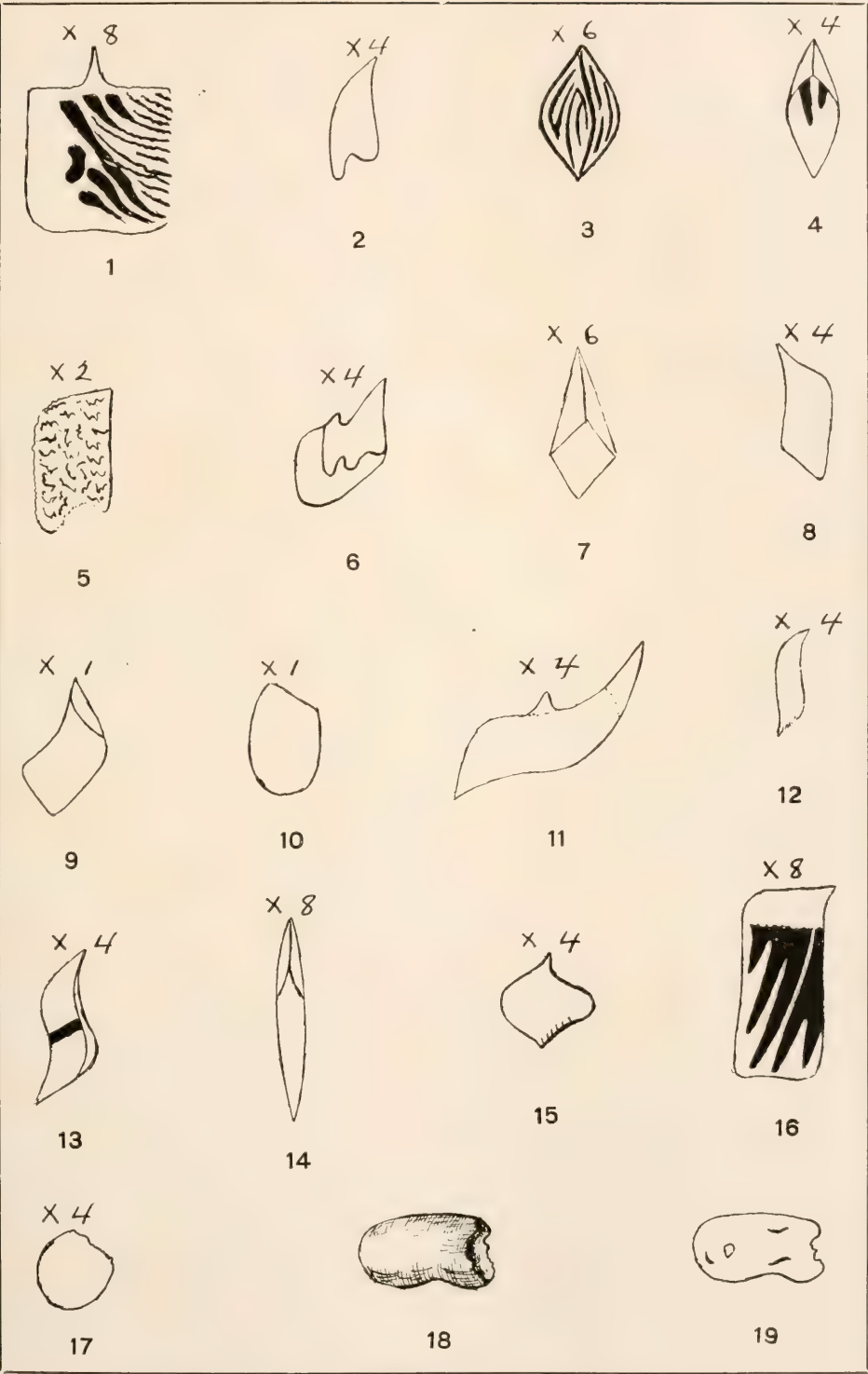
On the other hand the presence of abundant tourmaline, much plagioclase, with garnet, zoisite, vermiculite, etc., is indicative of pegmatitic assemblages, and it is therefore more probable that these corundum veins represent granitic pegmatites which have so reacted with the wall rocks as to almost lose their identity. The contact zones are somewhat different from those of the plumasites described above, but wide variations are to be expected depending on the composition of the original pegmatitic solutions, and even more so on the character of the peridotite or pyroxenite, and on whether these had already been hydrated to serpentine. It may be noted that much magnesia was assimilated by the pegmatitic solutions with the formation of much chlorite and biotite (since altered to vermiculite) and some spinel in the corundum veins. The distinct chloritic zones are evidence of reaction with the wall rock, whereby alumina was furnished by the pegmatitic solutions, and magnesia by the peridotite. The zone of enstatite may be explained by silication of the olivine, perhaps by the reaction $\text{Mg}_2\text{SiO}_4 + \text{SiO}_2 = 2\text{MgSiO}_3$ or the mineral may have been produced by abstraction of some of the magnesia. Incidentally it is rather unusual to find enstatite rather than anthophyllite. The position of the talc zone between the dunite and the enstatite is anomalous, but it might be noted that most of the analyses of the North Carolina dunites show the presence of water, and more or less alteration to serpentine.

SUMMARY OF MINERALOGY OF DESILICATED GRANITIC PEGMATITES.

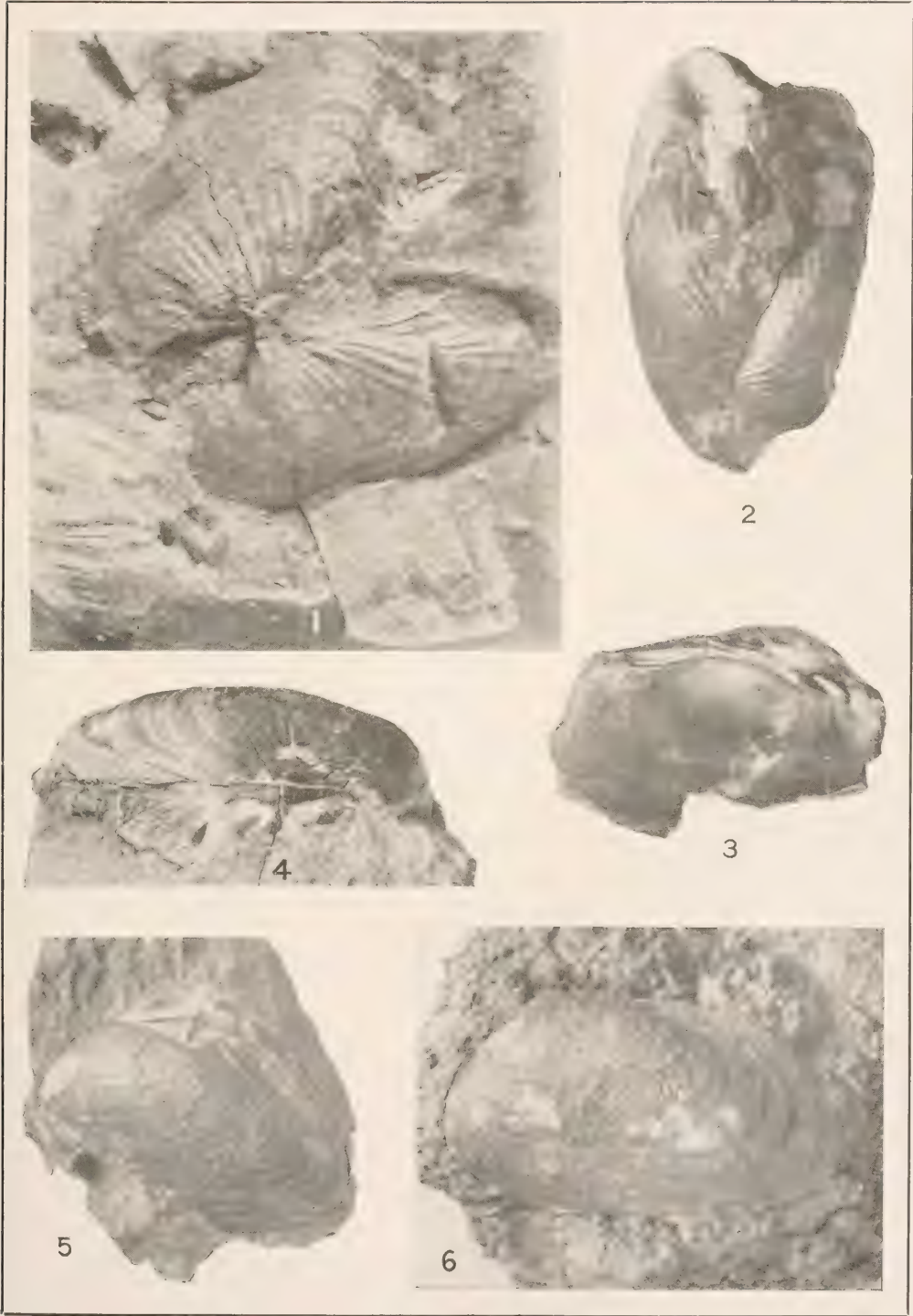
The mineralogical composition of this group depends largely on the composition of the original pegmatitic solutions, that of the wall rock (peridotite, pyroxenite, serpentine, etc.), and the degree of desilication or extent of reaction between the two. Variations in the character of the zones also occur. In some cases different periods of mineralization, some distinctly later than others, may occur. The minerals, exclusive of those occurring in the contact zone, which are more properly to be regarded as contact metamorphs of the peridotites, serpentines, etc., are listed below.

PRIMARY. *Trisilicates* (*feldspars*): albite, oligoclase, andesine, labradorite, anorthite. *Metasilicates* (*amphiboles*): actinolite, hornblende (edenite), (*miscellaneous*) beryl. *Orthosilicates* (*garnets*): almandite, rhodolite, (*boro-*) tourmaline, (*oxy-*) sillimanite, (*hydroxy-*) epidote, zoisite, allanite; (*micas*) muscovite, damourite, euphyllite, biotite, margarite; (*chlorites*) corundophilite, etc. *Hydrous metasilicates*: chabazite, wellsite. *Phosphates*: apatite. *Oxides*: corundum, spinel, diaspore, rutile, brookite, ilmenite, quartz (rare). *Sulfides*: molybdenite, pyrite.

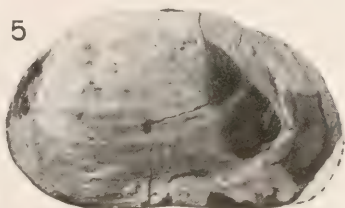
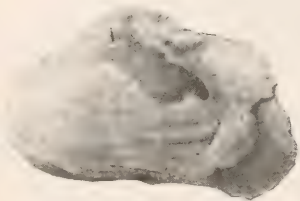
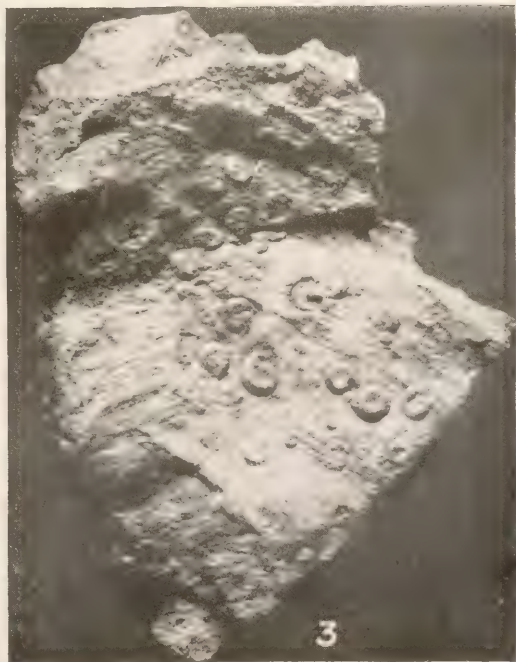
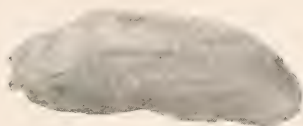
WEATHERING PRODUCTS. *Hydrous silicates*: kaolinite, colerainite, vermiculite (jefferisite), etc. *Carbonates*: aragonite. *Hydrous oxides*: limonite.



WANNER: FAUNAL REMAINS FROM YORK COUNTY.

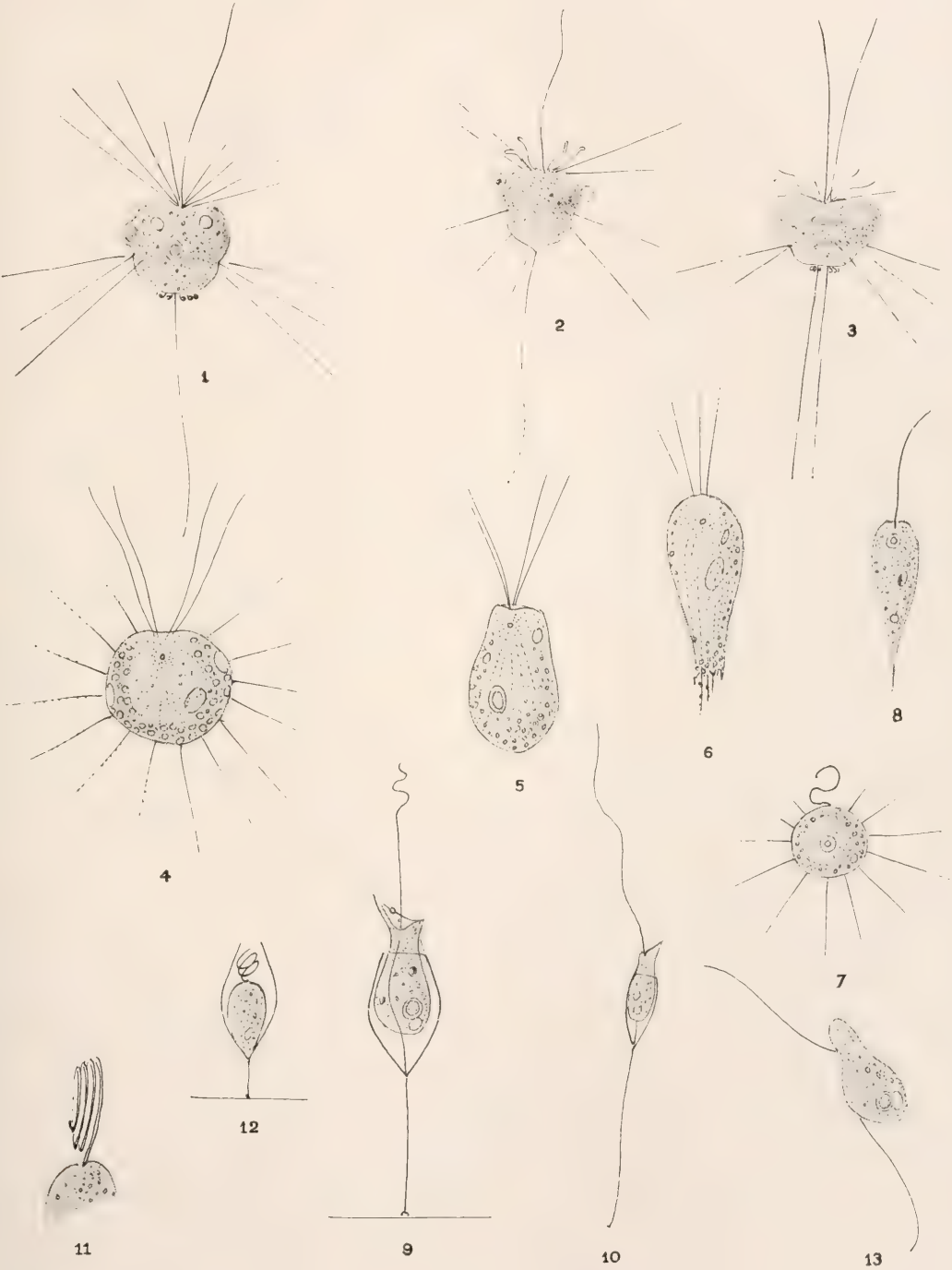


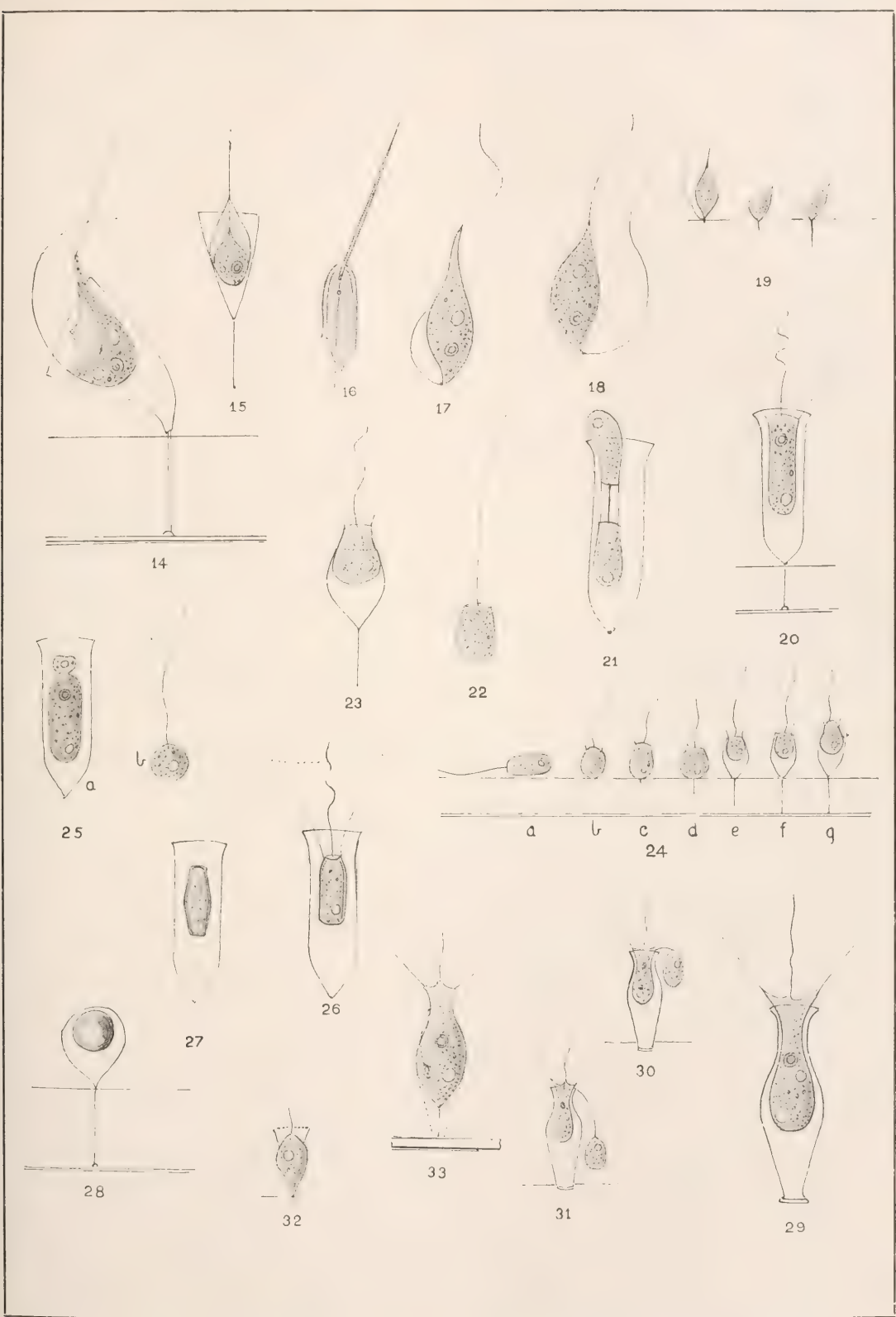
WANNER: FAUNAL REMAINS FROM YORK COUNTY.

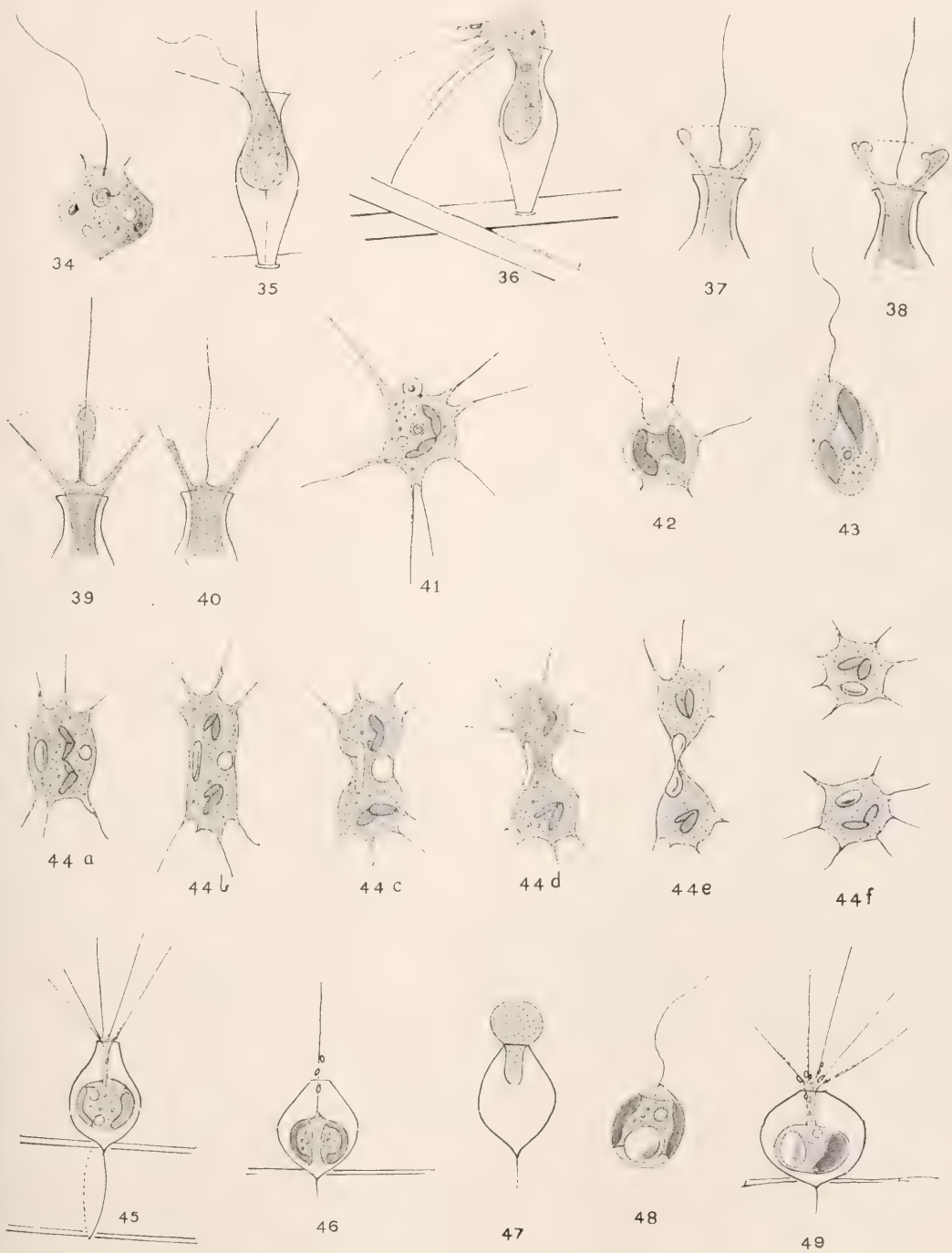


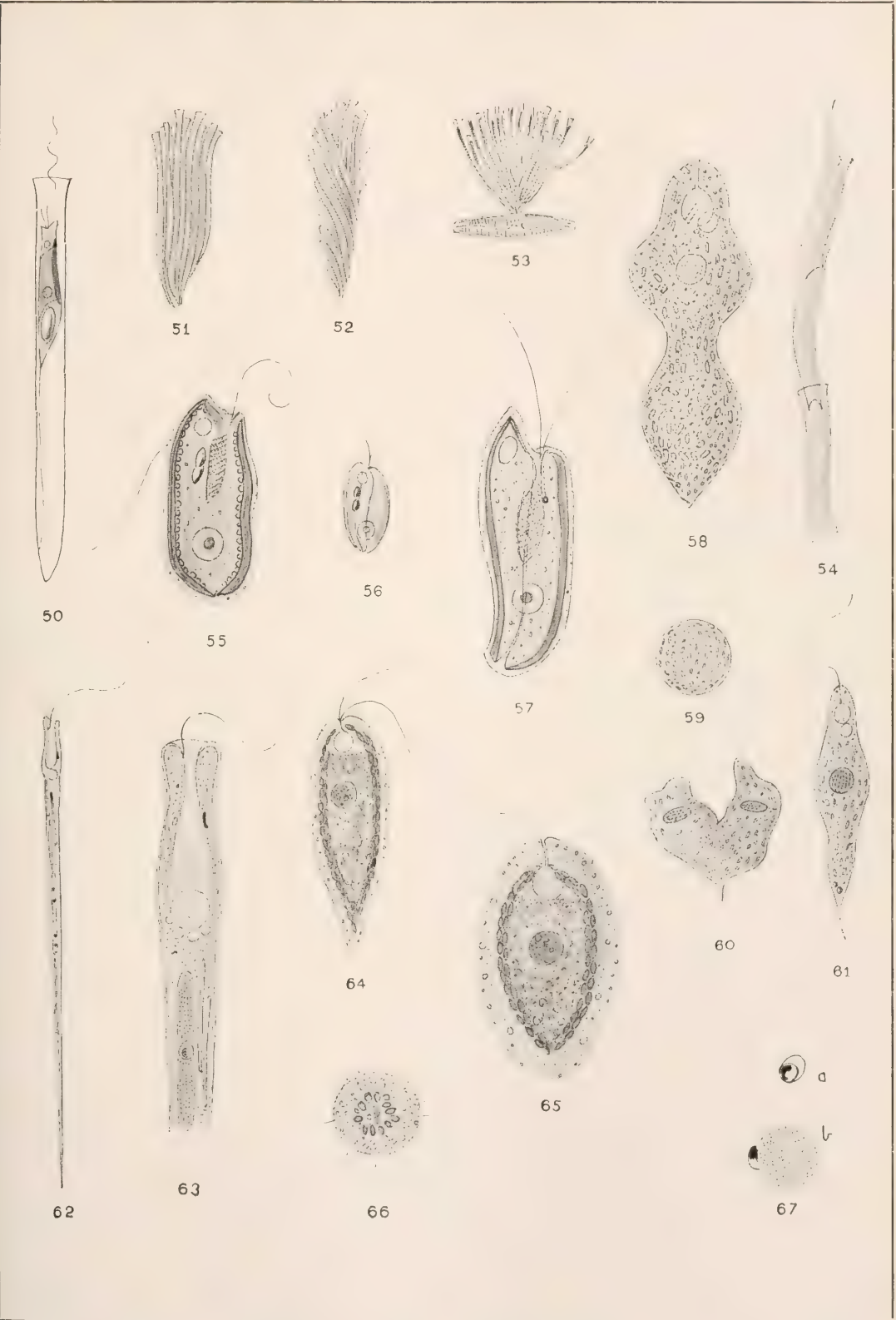
WANNER: FAUNAL REMAINS FROM YORK COUNTY.











**SOUTH AMERICAN BLATTIDAE FROM THE MUSEUM NATIONAL
D'HISTOIRE NATURELLE, PARIS, FRANCE.**

BY MORGAN HEBARD.

Having recently reported on the undetermined American Dermaptera of the Paris Museum,¹ the undetermined American Blattidae were next sent us for study by Monsieur Lucien Berland of that institution. The North American material does not include any large collections and will be reported on in several papers based largely on the Philadelphia collections and now in the course of preparation.

The South American series, on the other hand, proved to be large and intensely interesting. As it was almost entirely from three very distinct regions (French Guiana, southeastern Brazil and northern Argentina), we have prepared a single report on the collections, dividing it into three sections on a geographic basis and have included material of our own collections which had not previously been studied.

The series sent by the Paris Museum has been returned, with the exception of sets of duplicates, now in the collection of the author, deposited at The Academy of Natural Sciences of Philadelphia. We have also been most generously permitted to retain certain unique individuals of previously known species, of great importance in our further studies on the subject. For these, an equivalent in other material has been sent the Paris Museum.

The 637 specimens recorded represent 49 genera and 99 species, of which 8 genera and 34 species are described as new.

We wish to thank most heartily, Monsieur Lucien Berland and Docteur Lucien Chopard, for their kind assistance in affording us the opportunity to study this material.

Section I. FRENCH GUIANA.

This series represents the first large collection of Blattidae to be studied from French Guiana. The series includes 103 specimens,

¹ Proc. Acad. Nat. Sci. Phila., 1920, pp. 337 to 353, (1921).

representing 23 genera and 32 species, of which 3 genera and 9 species are new. Though large, the collection probably includes only a small percentage of the Blattidae to be found in French Guiana, one of the richest regions of tropical South America.

Among the new species, most remarkable and interesting are; *Sciablatta poecila*, *Leuropeltis atopa*, *Zetoborella gemmicula* and *Oulopteryx dascilloides*. The large Panchlorid, *Schizopilia fissicollis*, is one of the most interesting species of the region, due to the extraordinary pronotal specialization. This species appears to be rare in collections.

ECTOBIINAE.

Anaplecta maronensis new species. Plate IX, figure 3.

This minute insect agrees closely with *A. cabimae* Hebard in size and form; differing in the buffy pronotal disk with large prouts brown suffused area above the head, buckthorn brown and consequently distinctly less tawny tegmina and decidedly longer appendicular field of the wings.

Type: ♀ : La Forestière, Upper Maroni River, French Guiana. [Paris Museum.]

Size very small, form slender for the genus. Head scarcely longer than broad; vertex evenly convex, without distinct ridges over the antennal sockets; ocellar spots subobsolete. Pronotum approaching oval, the caudal margin showing no more truncation than the mesal portion of the cephalic margin, very feebly obtuse-angulate convex; surface weakly convex, with no trace of discal sulci. Tegmina extending a brief distance beyond apex of abdomen, narrow; costal margin very feebly convex to near the apex, where it bends more sharply to meet the sutural margin, which is almost straight, apex sharply rounded; costal veins inconspicuous, not numerous (8), with a few spurious intermediate veins distad; discoidal sectors two in number. Wings not broad; costal veins simple, subobsolete in clouded area (4 to 5), combining with the similar distal veinlets (4 to 5), which also spring from the discoidal vein as it curves to meet the median vein at the distal extremity of the medio-discoidal area; medio-discoidal area, before this point, without transverse veinlets; appendicular field in length about four-fifths that of remaining portion of wing, length appreciably greater than width. Supra-anal plate roundly produced, showing scarcely any angulation. Subgenital plate of the valvular type characteristic of the genus. Ventro-cephalic margin of cephalic femora with a single very slender and elongate proximal spine, succeeded by a row of microscopic, very short, rather closely set spinulae, terminated distad by two very slender spines, very elongate in increasing ratio distad. Other

femoral margins, pulvilli, tarsal claws and arolia as characteristic of the genus.²

Allotype: ♀; same data as type. [Hebard Collection.]

Specimen much damaged. Agrees with type in ambisexual characters, differing as follows. Form almost imperceptibly more slender. Genitalia so damaged that the subgenital plate alone can be seen to bear two simple styles, much of the type found in *A. lateralis* Burmeister, the sinistral being the longer and heavier and directed dextrad.

Head chestnut brown. Pronotum with disk ochraceous-buff, with a large suffusion of prouts brown in area above the head, lateral portions translucent buffy. Tegmina translucent buckthorn brown, except in narrow marginal field which is translucent buff. Wings with appendicular field heavily tinged with mummy brown. Cerci, underparts and limbs warm buff. Ventral surface of abdomen ochraceous-buff, suffused broadly but not heavily both laterad and distad with prouts brown.

Length of body ♂ 4, ♀ 4.1; length of pronotum ♂ 1.2, ♀ 1.2; width of pronotum ♂ 1.7, ♀ 1.7; length of tegmen ♂ 3.6, ♀ 3.9; width of tegmen ♂ 1.4, ♀ 1.4; length of appendicular field of wing ♂ 2.5, ♀ 2.5 mm.

This strikingly colored species is known from the described pair.

***Anaplecta pulchella* Rehn.**

1906. *Anaplecta pulchella* Rehn, Proc. Acad. Nat. Sci. Phila., 1906, p. 262. [♀; Demerara, British Guiana.]

Albina, Maroni River, Dutch Guiana, 1 ♂.

This specimen, the first male of the present species to be studied, is seen to have the supra-anal plate large, extending as far as the subgenital plate, with lateral margins converging weakly, then more strongly and curving into the truncate distal portion. The subgenital plate with distal margin between the styles transverse and moderately hairy, the dextral margin simple, oblique, the sinistral margin transverse to sinistral style, with surface of plate in that section broadly channeled, this portion produced into the sinistral style, which is straight, produced for a brief distance, the margin at the inner margin of this style suddenly produced for a short distance, in consequence of which the sinistral style is deeply inset, its projecting portion equal in size and extending caudad the same distance as the well-socketed, simple dextral style.

² Described in Mem. Am. Ent. Soc., No. 4, p. 17, (1920).

PSEUDOMOPINAE.

Sciablatta poecila³ new species. Plate IX, figures 12, 13, 14 and 15.

The comparatively thorough color description of Walker's *Blatta varicornis* from Santarem, Brazil,⁴ leaves little doubt but that the present species is very closely related. From that description, *varicornis* appears to differ only in the tegmina; "brown, with whitish veins, and with a broad whitish hyaline costal space which tapers towards the tip." The structural characters will probably show much more important differences for that species, though we feel that it may safely be assigned to *Sciablatta*.

Compared with the genotype, *S. mamatoco* Hebard, described from Santa Marta, Colombia,⁵ *poecila* differs in the male sex in the smaller size, broader form, delicate but more intricate and extensive markings, proportionately much broader pronotum, proportionately broader tegmina, with apices more nearly median in position and discoidal sectors slightly more oblique and subgenital plate, with the fused styles, much more elongate and slender.

In the specialization of the male subgenital plate and dorsal surface of the abdomen, greatest convergence in the known species of the Blattellae to the characteristic type found in the Oxyhaloid genus *Chorisoneura* is shown by this species.

The intricate markings of this insect are so delicate, except on head and antennae, that their real beauty is not realized until a microscopic examination is made.

Type : ♂; St. Jean du Maroni, French Guiana. March. [Paris Museum.]

Size medium small for the Group Blattellae, form very broad for the Group. Interocular space moderately broad, three-quarters as wide as that between the antennal sockets, flattened and showing weak, irregular impressions. Lateral margins of cheeks converging distinctly ventrad. Maxillary palpi very short, third joint very slightly longer than the enlarged fifth joint, fourth joint two-thirds as long, enlarged regularly and considerably distad. Tegmen with discoidal vein an equal distance from the costal and sutural margins mesad, costal margin rounding toward sutural slightly more than is usual in the Group, discoidal sectors (13 and 15) decidedly oblique, as oblique as the costal veins. Wings with (8) proximal costal veins moderately thickened in distal portions, mediastine vein unbranched, ulnar vein with (8, including two sub-

³ From ποικίλη = dappled.

⁴ Cat. Blatt. Br. Mus., p. 216, (1868).

⁵ Trans. Am. Ent. Soc., XLVII. p.115, (1921).

divisions) complete branches, intercalated triangle ample, nearly two-thirds as broad as long. Dorsal surface of abdomen with sixth tergite shallowly concave meso-proximad, this area transverse oval in outline, its surface carpeted with agglutinated hairs. Seventh and eighth tergites distinctly narrower, moderately exposed along their caudal margins. Supra-anal plate triangular with apex blunted, subchitinous, subemarginate, its length approximately two-fifths its basal width, showing no slight emargination at the cercal bases as does that of *mamatoco*. Cerci much as in that species, but smaller, the (10) joints similarly well defined. Paired plate beneath supra-anal plate large and unspecialized. Subgenital plate with surface very weakly convex, very short, sinistral portion slightly more produced than dextral, caudal margin nearly transverse, showing very slight production to median fourth, dextrad very feebly concave, median portion fusing with the large, elongate and lamellate styles, which are represented by nearly vertical plates, attingent at their distal extremities, each about two and one-half times as long as its basal width, the disto-dorsal angle very broadly convex, the disto-ventral angle bluntly, but much more sharply, convex. These plate-like cerci in the present species give to the subgenital plate a strongly Chorisoneurine facies. Limb armament, pulvilli, arolia and tarsal claws as characteristic of the genus.⁶

General coloration buffy, with a faint tinge of buckthorn brown. Head very pale flesh color, occiput with four irregular, vertical streaks and flecks of dark prouts brown, a transverse band of prouts brown between the eyes just above the ocelli, narrow laterad but wider mesad, due to the greater convexity of its dorsal margin, a very broad transverse band of prouts brown between the antennal sockets, which contains a very broadly V-shaped transverse buffy area mesad. Mouthparts and palpi clear clay-color. Antennae in proximal (24 joints) portions clear clay-color, succeeding ten joints mummy brown, followed by a striking and broad annulus (including 5 joints) of warm buff, the remaining distal joints mummy brown. Pronotum with disk light ochraceous-buff, broad lateral portions transparent, the whole faintly tinged with buckthorn brown, disk thickly tessellate with minute dots and a few lines of prouts brown, as figured, broad lateral portions and cephalic margin marked with more scattered and even smaller dots of prouts brown, the entire immediate margin, from point of greatest width caudad, of this color. Tegmina transparent, faintly tinged with buckthorn brown, marginal field with many very minute flecks of ochraceous-tawny, other portions with minute areas between veins, spurious veins and veinlets ochraceous-tawny, these proximad irregularly square or transverse, distad longitudinally linear and all so fine as to be individually scarcely appreciable to the naked eye.

⁶ Described in Trans. Am. Ent. Soc., XLVII, p. 115, (1921).

Wings transparent, showing a faint tawny tinge, area of costal veins in proximal portion clouded, in basal portion with bister and in area of enlarged portions of veins buffy, in distal portion with narrow, interrupted suffusions of bister between the veins, this more weakly continued around the distal margin of the anterior field in buckthorn brown. Remaining dorsal surface ochraceous-buff, shading to chestnut brown laterad and on supra-anal plate, the immediate latero-caudal angles of the tergites and free margin of the supra-anal plate buffy, these areas, however, not sharply defined. Cerci clear ochraceous-buff. Limbs clear ochraceous-buff, coxae in large external portions dark prouts brown, median femora in a small area and caudal femora in a much larger area flecked ventro-distad on caudal faces with dark prouts brown, the corresponding tibiae with several heavy flecks of this color on dorsal and caudal faces, the cephalic tibiae with fewer and smaller weak brownish areas. Ventral surfaces of abdomen light ochraceous-buff, with an irregular fleck and suffusion, as well as dots, of prouts brown laterad toward the laterad margins.

Length of body 10, length of pronotum 2.6, width of pronotum 4, length of tegmen 11.2, width of tegmen meso-proximad 4, width of tegmen mesad 3.9, length of wing 10.6, width of wing 6.3, width of intercalated triangle 1.7, length of caudal femur 3.7 mm.

The type of this extraordinary insect is unique.

Neoblattella platystylata new species.

Charvein and St. Jean du Maroni, French Guiana.

Described on page 229.

Neoblattella adpersicollis (Stål)

1861. *Blatta adpersicollis* Stål, Kongl. Svenska Freg. Eugenie's Resa, Ins., p. 308. [♂; Rio de Janeiro, [Brazil].]

La Forestière, Upper Maroni River, French Guiana, 1 ♂.

This large species is of particular interest as genotype of *Neoblattella*, see page 232.

LEUROPALTIS⁷ new genus.

This genus is erected to include one of the most aberrant forms of the Group Blattellae known to us. The broad flattened head and prominent eyes suggest a further development of the type usually shown by species of the Group Euphyllodromiae. The flat pronotum and armament of the ventro-cephalic margins of the cephalic femora afford distinctive characters.

Though agreeing in the flattened form (though this is more decided in the present insect), character of limb armament, pulvilli, tarsal

⁷ From λευρός = flat and πέλτη = a light shield.

claws and arolia, *Leuropeltis* differs very strikingly from the Nyctiborine genus *Pseudischnoptera* in the even more decidedly flattened and shorter head, eyes which are more decidedly developed laterad and extend ventrad well beyond the antennal sockets, more transverse, oval pronotum with greatest width mesad and lateral portions not at all deflexed, broader tegmina with longer anal field, spurious veins absent and discoidal sectors decidedly oblique, broader wings with area of costal veins much wider and ulnar vein with all branches complete, unspecialized median segment but specialized sixth abdominal tergite of male, very distinctive genitalic development in this sex, ventro-cephalic margin of cephalic femora with two heavier terminal spines and both cephalic and caudal ventral margins of other limbs armed, the caudal margins less heavily than in *Pseudischnoptera*.

In linear arrangement, the genus can not be satisfactorily assigned, due to the fact that many aberrant genera of the Group Blattellae exist, radiating away from the normal toward other totally different types. We place *Leuropeltis* after *Liosilpha* Stål, from which genus, however, it is very widely separated.

Genotype.—*Leuropeltis atopa* new species.

Generic Description. Genus known only from the male sex. Head flattened, eyes large, widely separated and prominent, antennae coarse and well supplied with short hairs. Pronotum rectangularly oval, moderately transverse, greatest width mesad, surface flat, the disk showing two pairs of oblique impressions. Tegmina long and broad, anal field elongate, discoidal sections strongly oblique. Wings fully developed, marginal field extending over half distance to apex, scapular field very broad in distal half, costal veins thickening but not clubbed distad, ulnar vein with branches complete, intercalated triangle subobsolete. Abdomen with latero-caudal angles of five proximal tergites sharp, rectangulate, weakly produced, tergites decidedly narrower after sixth, sixth tergite specialized mesad. Cephalic femora with ventro-cephalic margin unarmed except in distal third, where it is supplied with short, stout spines, terminating in two heavier elongate distal spines, of which the more distal is slightly the more elongate; ventro-caudal margin unarmed except in distal third, where it is supplied with a few moderately large, elongate spines. Other ventral femoral margins moderately supplied with similar spines, which, particularly on the cephalic margins, are not as heavy or as large as those often developed in the Pseudomopinae. Caudal metatarsus armed ventrad with two rows of minute spinulae and supplied distad with a moderately large pulvillus, three succeeding tarsal joints supplied with similar pulvilli, occupying their entire ventral surfaces. Large

chitinous arolium present between the bases of the rather stout, simple, symmetrical tarsal claws.

Leuropeltis atopa new species. Plate X, figures 11, 12 and 13.

This species is so distinctive that a helpful comparison can hardly be made with any known Blattid. The rich brown of the tegmina and pronotal disk, pale lateral portions of the pronotum and bicolored antennae, are the more striking features of coloration.

Type: ♂; Gourdonville, French Guiana. October. [Paris Museum.]

We add the following features to those given in the generic diagnosis. Interocular space (1.1 mm.) three-quarters as wide as that between the antennal sockets. Ocellar spots small. Inter-ocular-ocellar area flattened, very weakly concave. Maxillary palpi with distal joint equal in length to third, the dorsal margin showing a very weak concavity, fourth joint three-quarters as long as third, enlarging evenly and rather strongly distad. Pronotum with margin above head transverse, showing a very feeble convexity, caudal margin transverse very broadly and weakly convex, lateral margins evenly convex; first pair of impressions on disk situated slightly cephalad of the median line and parallel to the normally placed latero-caudal sulci. Tegmina with greatest width at apex of anal field, thence narrowing very feebly to distal portion where the narrowing is more decided, particularly on the sutural margin, with apex situated slightly beyond the median point toward the costal margin. Wings with (12) thickened costal veins; ulnar vein with six branches, two of which again divide before the margin of the wing. Sixth tergite subchitinous in median portion, with a small, rounded prominence mesad near the caudal margin of the preceding tergite, the bases of which prominence latero-cephalad are supplied on each side with a minute tuft of agglutinated hairs. Supra-anal plate triangularly produced, with apex curving ventrad and broadly rounded, length two-fifths distance between cercal bases. Cercus with ten joints, the tenth moderately elongate oval.⁸ Subgenital plate moderately asymmetrical, the sinistral margin situated further caudad than the dextral, straight, transverse to median section; the dextral margin broadly concave oblique to median section; median section with two large and roughly triangularly rounded plates on each side, the sinistral more inset, due to the position of the sinistral free margin, between these the median portion of the plate is produced in a large, but no more produced, likewise roughly triangular plate, the emarginations between this and the styles (developed into plates in this species) rather broadly V-shaped. Ventro-cephalic margin of cephalic femora with (6 and 7) short stout spines distad, ventro-caudal margin with (3) heavier,

⁸ The sinistral cercus is apparently deformed in the present specimen.

longer spines in homologous portion of margin. Caudal metatarsus one and one-quarter times as long as combined length of succeeding joints.

Head and palpi chestnut brown, obscurely vertically streaked with paler on occiput, ocellar spots buffy. Antennae blackish chestnut brown in proximal third, thence hazel. Pronotum blackish chestnut brown in large truncate-trigonal area, margined very narrowly laterad with warm buff; lateral portions transparent, very feebly tinged with buff. Tegmina weakly translucent, clear solid hazel tinged with chestnut brown, particularly at the humeral trunk and along the costal margin. Wings transparent, anterior field tinged with saccardos umber, heaviest in area of enlarged portion of costal veins, very weak between discoidal and ulnar veins except distad and very weak between unbranched portion of ulnar vein and anal sulcus; radiate field very weakly tinged with saccardos umber, the veins of that color. Dorsal surface of mesonotum, metanotum and abdomen shining and very dark chestnut brown. Cerci dark chestnut brown. Ventral surface and limbs blackish, the subgenital plate and limbs beyond the femora paling to very dark chestnut brown.

Length of body 15, length of antenna 18.8, length of pronotum 4, width of pronotum 5.7, length of tegmen 17.9, width of tegmen 5.9, length of wing 15, greatest width of costal field of wing 2, length of cercus 2.9, length of caudal tibia 5.7, length of caudal metatarsus 2.1 mm.

The type of this remarkable insect is unique.

Euphyllodromia literata (Burmeister)

1838. *Bl[atta] literata* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 497. [Surinam [= French Guiana].]

1839. *Blatta alternans* Serville, Hist. Nat. Ins., Orth., p. 114. [♀, Cayenne [= French Guiana].]

1903. *Pseudophyllodromia pavonacea* Rehn, Trans. Am. Ent. Soc., XXIX, p. 262. [♂; Bartica, British Guiana.]

Study of the Guianan material now in the Philadelphia collections and of the literature, furnishes much evidence indicating the above synonymy. Rehn's *pavonacea* was described at a time when little material was available, and the generic association of the American Blattidae in chaos. The description of Serville's *alternans* was thus apparently overlooked, while nothing could be done with *literata* of Burmeister, until much Guianan material could be secured.

It is unfortunate that Burmeister's wretched description of *literata*, occupying less than two lines, has a year's priority over Serville's readily recognizable diagnosis of *alternans*.

Nouveau Chantier, French Guiana, 1 ♂.

St. Jean du Maroni, French Guiana, October, 1 ♀.

La Forestière, upper Maroni River, French Guiana, 2 ♀.

Euphyllodromia chopardi⁹ new species. Plate XV, figures 1 and 2.

This species is related to *E. fasciatella* (Saussure), differing in the slightly larger eyes, slightly narrower interocular space, heavier latero-caudal depressions of pronotal disk, heavier and differently specialized appendages of the male subgenital plate and longer caudal metatarsi.

In coloration it differs in having the maxillary palpi not immaculate, as the distal joint is suffused with mummy brown in its ventral marginal portion; the pronotal disk margined with a narrow whitish suffusion and not immaculate, but having two heavy, extensive lateral suffusions of dark brown, which fuse caudad, and the tegmina with similar translucent and transparent areas, but entirely lacking pearl gray lines and spots.

Type: ♂; Bartica, British Guiana. December 19, 1912. (H. S. Parish.) [Acad. Nat. Sci. Phila., Type no. 5369.]

Size rather small, form moderately slender for the genus, delicate structure normal. Head with interocular space (.6 mm.) about three-fifths width between antennal sockets. Ocellar spots small and weakly defined. Maxillary palpi with third joint three-quarters as long as fourth; fourth very strongly triquetrous, widening evenly distad so that it becomes fully two and one-half times as wide as third; fifth joint three-quarters as long as fourth, moderately expanded, greatest width near base, ventral margin sub-convex and oblique from that point to apex. Pronotum rather decidedly transverse; cephalic margin weakly convex, truncate; lateral margins rather strongly convex, this greatest caudad; caudal margin transverse, but showing an even and very broad obtuse-angulation, with angle very broadly convex; discal sulci very broad but well developed. Tegmen and wings elongate and very delicate. Dorsal surface of abdomen as described for *E. decastigmata* Hebard,¹⁰ apparently characteristic of the genus, sixth tergite very shallowly concave in mesal portion, there rather thickly supplied with agglutinated hairs. Supra-anal plate strongly transverse, broadly and weakly triangularly produced between the cercal bases, with rounded apex obtuse-angulate. Cercus as in *decastigmata*, tapering to the acute apex. Paired plate beneath supra-anal plate large and unspecialized. Subgenital plate almost symmetrical, the sinistral margin almost straight, the dextral margin rather strongly concave to the median portion; median portion with two deeply inset, large

⁹In honor of the distinguished Orthopterist, Dr. Lucien Chopard.

¹⁰Mem. Am. Ent. Soc. No. 4, p. 84, (1920).

plates, which are attingent distad; the sinistral as long as broad and nearly triangular, with broad apex rounded; the dextral twice as long as broad and nearly rectangular, with similar apex; fitting tightly between the bases of these styles is a triangular plate, with dextral margin curled slightly caudad and armed with minute, sharp, straight teeth, which slant slightly proximad. Armament of limbs, pulvilli, tarsal claws and arolia as characteristic of the genus. Succeeding tarsal joints only half as long as caudal metatarsus.

Allotype: ♀; same data as type, but taken February 10, 1913. [Acad. Nat. Sci. Phila.]

Agrees closely with type in coloration, color-pattern and in structural features except the following. Interocular space slightly over half width between antennal sockets. Dorsal surface of abdomen unspecialized. Supra-anal plate very strongly transverse, the free margin very weakly obtuse-angulate convex on each side to the weakly concave median portion. Subgenital plate with lateral margins feebly convex and hardly convergent to opposite cercal bases, thence rounding strongly and oblique, broadly concave to distal portion, which is strongly V-emarginate, the apices thus formed broadly rounded, the emargination occupied by a soft mantle.

Head, underparts and limbs weak ochraceous-tawny, the occiput slightly deeper than the face, abdomen ochraceous-tawny with styles largely suffused with chestnut brown. Maxillary palpi light buff, the half of the distal joint toward the ventral margin heavily suffused with mummy brown (this showing variation in width in the series), broader on the caudal than on the cephalic face. Antennae with first joint ochraceous-tawny, succeeding joints blackish mummy brown, the proximal joints sometimes ochraceous-tawny dorsad. Pronotum in all but discal portion transparent, faintly tinged with buckthorn brown and with a weakly defined, narrow, opaque margin of whitish about the disk; disk tawny, with two large suffusions of mummy brown, which unite caudad and send a very short stout ray cephalad into the median paler area. In intensive examples these suffusions almost completely obliterate the paler median area, leaving only a medio-longitudinal line and fleck of ochraceous-tawny cephalad. Tegmina with marginal field, areas between discoidal and median veins and anal sulcus and the two mesal areas between veins of anal field transparent, very faintly tinged with buckthorn brown; remaining portions more heavily tinged with buckthorn brown, becoming cinnamon-brown in proximal area of costal veins proximad and tapering to a weak mars brown suffusion in this area distad; the sutural margin, particularly in the anal field and area between anal sulcus and first vein of anal field, rather heavily suffused with mars brown; a broad suffusion of ochraceous-orange sweeping obliquely across the discoidal field,

beyond the apex of the anal field. Wings transparent, iridescent, feebly suffused distad, veins chestnut brown, a median suffusion of chestnut brown in area of costal veins, beyond which the narrow marginal area is buffy. Mesonotum ochraceous-tawny, heavily and extensively suffused with mummy brown in latero-cephalic portions covered by the pronotum, this showing through that transparent portion of the pronotum and giving it the appearance of being darkened caudad, with a meso-caudal fleck of warm buff; metanotum similar except that there is no median fleck, but a similar fleck of warm buff on each side caudad of the dark suffusions. Dorsal surface of abdomen ochraceous-orange, the median segment with a heavy transverse suffusion of mummy brown, which in intensive examples occupies the entire segment and is blackish.

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
♂					
Bartica, British Guiana, <i>type</i>	10.3	2.8	3.7	10.3	2.8
Bartica, British Guiana, <i>para-</i> <i>types</i> (9)	10.-10.9	2.6-2.8	3.6-3.7	9.6-10.3	2.6-2.8
Gourdonville, French Guiana	9.2	2.6	3.6	9.8	2.6
♀					
Bartica, British Guiana, <i>allo-</i> <i>type</i>	10	2.7	3.7	9.8	2.8
Bartica, British Guiana, <i>para-</i> <i>types</i> (2)	9.2-10.3	2.7-2.7	3.5-3.6	9.8-10	2.5-2.6
Demerara, British Guiana, (4)	9.9-10.5	2.7-2.7	3.6-3.7	9.7-9.9	2.7-2.7

Specimens Examined; 20; 12 males and 8 females.

Bartica, British Guiana, December 10 to June 12, 1912 and 1913, (H. S. Parish), 10 ♂, 4 ♀, *type*, *allotype*, *paratypes*, [A. N. S. P.].

Demerara, British Guiana, 1901, (R. J. Crew), 4 ♀¹¹, [Hebard Cln.]

Gourdonville, French Guiana, October, 1 ♂, [Paris Mus.].

Charvein, French Guiana, November, 1 ♂, [Hebard Cln.].

NYCTIBORINAE.

Pseudischnoptera lineata (Olivier) Plate XI, figure 14.

1789. *Blatta lineata* Olivier, Encycl. Méthod., Ins., IV, p., 17. [No locality given.¹²]

St. Jean du Maroni, French Guiana, 1 ♂.

Kourou, French Guiana, April, 1 ♂.

This strikingly colored and extraordinary species has been dis-

¹¹ Recorded by Rehn as *Pseudophyllodromia obscura* Saussure, Proc. Acad. Nat. Sci. Phila., 1906, p. 264, (1906).

¹² This species has subsequently been recorded from Cayenne and the Antilles, the latter very possibly in error.

cussed at considerable length by Saussure.¹³ The following features have, however, never been given.

Pronotum very much flattened but with comparatively narrow pale lateral portions showing some slight deflection, greatest width at latero-caudal angles. Tegmina with discoidal sectors almost longitudinal, false longitudinal veins as decided as the veins themselves and with supplementary false veinlets between these in distal portions. Limbs comparatively short and heavy. Ventro-cephalic margin of cephalic femora armed in distal third with (5 and 8) short but decidedly stout spines, terminating in three heavier spines, slightly more elongate in slightly increasing ratio distad, ventro-caudal margin with (4) heavier, longer spines in distal third. Large pulvilli present between the rather stout, simple, nearly symmetrical tarsal claws. Median segment with a large, transverse, median depression, formed by the fusion of two circular depressions.¹⁴ Supra-anal plate triangularly produced, with a large, straight, heavy spine directed caudad at each side of the broadly rounded apex. Concealed genitalia including at least three very heavy, slightly curved spines. Subgenital plate as figured.

Length of body 17-17.6, width of interocular space .9, length of pronotum 4.8-4.8, width of pronotum 6.6-6.5, length of tegmen 17.7-18, width of tegmen 5.3-5.7, length of wing 14, width of wing 7.7 mm.

This insect does not belong to the Pseudomopinae, as has been supposed, but is clearly a member of a distinctive group of the Nyctiborinae. This is shown by the general structure, character of tegminal and wing venation, limb characters and type of male subgenital plate, which type is found in numerous species of this subfamily only. The genus does not agree with the majority of the genera of the Nyctiborinae, showing complete absence of pilosity and only very slightly asymmetrical tarsal claws.

Nyctibora holosericea Burmeister.

1838. *N[ychibora] holosericea* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 502. [Cameta, Brazil.]

Gourdonville, French Guiana, 1 ♂.

Charvien, French Guiana, 1 ♀.

The present specimens appear to agree with Burmeister's two line description of *holosericea* better than any we have previously seen from South America. Comparing the material here recorded with Central American specimens of *N. noctivaga* Rehn, the two species, as here recognized, are seen to be very closely related.

¹³ Miss. Sci. Mex., Rech. Zool., VI, p. 66, (1870).

¹⁴ Partially filled with a pale waxy substance, which in drying has become hard, like shellac.

In the Guianan material the interocular area is not dark, being as pale as, or paler than, the face; in the specimens of *noctivaga* the interocular area, to slightly below the ocelli, is very dark, darker than the face in paler examples, as dark as the face when the face is very dark. The dorsal surface of the abdomen is comparatively pale, darkening slightly caudad, without striking markings. In the males the supra-anal plate differs.

Length of body ♂ 30, ♀ 36; length of pronotum ♂ 8.3, ♀ 10; width of pronotum ♂ 12.8, ♀ 14.1; length of tegmen ♂ 37.5, ♀ 38.6; width of tegmen ♂ 13.9, ♀ 15 mm.

Paratropes elegans (Burmeister)

1838. *Ph[oraspis] elegans* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 493. [Surinam?]

La Forestière, upper Maroni River, French Guiana, 1 ♀.

EPILAMPRINAE.

Epilampra azteca Saussure.

1868. *Epilampra azteca* Saussure, Rev. et Mag. de Zool., (2), XX, p. 356. [♂, Mexico.¹⁵]

Nouveau Chantier, French Guiana, 1 ♂.

Epilampra grisea (De Geer)

1773. *Blatta grisea* De Geer, Mém. l'hist. Ins., III, p. 540, pl. 44, fig. 9. [Surinam.]

Charvein, French Guiana, 1 ♀.

Epilampra abdomen-nigrum (De Geer)

1773. *Blatta abdomen-nigrum* De Geer, Mém. l'hist. Ins., III, p. 538, pl. 44, fig. 5. [[♂], Surinam.]

St. Jean du Maroni, French Guiana, 1 ♂, 1 ♀.

Epilampra maculicollis (Serville)

1839. *Blatta maculicollis* Serville, Hist. Nat. Ins., Orth., p. 92. [♀, Brazil.]

La Forestière, upper Maroni River, French Guiana, 1 ♀.

Epilampra conspersa Burmeister

1838. *E[pilampra] conspersa* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 505. [Pará, Brazil.]

St. Jean du Maroni, French Guiana, 1 ♀.

Nouveau Chantier, French Guiana, 1 ♀.

Tollinche, Maroni River, French Guiana, 1 ♀.

¹⁵ The Cuban material, originally included, represented a distinct species.

Hyporhienoda maronensis new species. Plate XII, figure 5.

This species is very closely related to *H. litomorpha* Hebard, from Colombia. Decided similarity is shown by the color and texture of the dorsal surface in the female sex. It differs in the more slender form, head with narrower interocular space and slightly heavier impressed punctae, stronger convexity of the thoracic segments and in the decidedly greater reduction of the limb armament.

Type: ♀; La Forestière, upper Maroni River, French Guiana. [Paris Museum].

Size medium, form elongate and rather narrowly oval for the genus, the greatest width being across the abdomen mesad. Head hidden under pronotum, broad, the reduced eyes widely separated by a distance (1.8 mm.) slightly greater than that between the weakly defined ocellar spots; exposed surface coarsely and rather thickly impresso-punctate, face flattened, very feebly convex, with two transverse impressions just below and between the ocellar areas and showing very slight concavity on each side above the labial suture. Pronotum extending well beyond head, showing a very feeble subcucullate condition, very strongly convex to the scarcely reflexed, narrow lateral portions of the cephalic margin; this margin subcingulate, broadly convex mesad but more strongly so than in *litomorpha*, with lateral margins broadly convex to the latero-caudal angles, which are rounded and weakly produced caudad, forming an angle of slightly less than ninety degrees; caudal margin broadly convex mesad, showing broad and very weak convexity laterad, so that it is nearly transverse. Mesonotum and metanotum with latero-caudal angles produced and sharply rounded. Entire dorsal surface apparently smooth, somewhat polished, but under high magnification seen to be supplied with minute flattened rounded rugae, these slightly more apparent on the caudal margins of the segments, so that they appear very finely beaded. Tegmina and wings absent. Supra-anal plate heavily chitinous, over twice as broad as long, the free margin convex, showing slight flattening laterad and a trace of median emargination. Cerci very short and lamellate, scarcely projecting beyond the body outline. Subgenital plate very large. Limbs showing very decided atrophy of armament. Ventro-cephalic margin of cephalic femora armed with three heavy spines, succeeded by an irregular row of rather elongate chaetiform spines, terminated by a heavy distal spine. Other ventral femoral margins, except caudal margins of caudal femora, which are wholly unarmed, supplied with a single heavy distal spine, all with widely spaced large spiniform hairs. Tarsi heavy, caudal metatarsus as long as combined length of succeeding tarsal joints, with two rows of spines ventrad and more distantly placed spines on the sides. Four proximal tarsal joints supplied with pulvilli, these occupying the entire ventral surfaces except that of the meta-

tarsus, the pulvillus of which is distal and about twice as long as wide. Tarsal claws simple, symmetrical, with very heavy bases. Arolia absent.

Dorsal surface blackish brown, the pronotum with a paired suffusion of sayal brown, extending a brief distance along the cephalic margin each side of the median point. Head tawny, the face darkened to mars brown. Antennae and palpi ochraceous-tawny. Ventral thoracic surface and limbs buckthorn brown, the latter with femora tinged with tawny, the tibiae deepening to mars brown in distal portions, spines mars brown. Ventral surface of abdomen deep carob brown, paling to rich chestnut meso-proximad.

Length of body 28.8, length of pronotum 9.5, width of pronotum 12.2, greatest body width 15.6, length of caudal femur 7.1, length of caudal metatarsus 2 mm.

In addition to the type, a single half-grown female, from Ilet la Mère, French Guiana, is before us. This specimen bears an additional spine on the median portion of the ventro-cephalic margin of the median femora, two similarly situated spines on the caudal femora and four and five proximal spines on the ventro-cephalic margins of the cephalic femora.

BLATTINAE.

Periplaneta brunnea Burmeister.

1838. *P[eriplaneta] brunnea* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 503. [♂, ♀: Chile; Demerara, [= British Guiana].]

St. Jean du Maroni, French Guiana.

PANCHLORINAE.

Panchlora cubensis Saussure.

1862. *P[anchlora] cubensis* Saussure, Rev. et Mag. de Zool., (2), XIV, p. 230. [♀, Cuba.]

St. Jean du Maroni, French Guiana, 1 ♂, 1 ♀.

Nouveau Chantier, French Guiana, 1 ♂.

La Forestière, upper Maroni River, French Guiana, 1 ♂.

Ouanary, French Guiana, 1 ♂.

Schizopilia fissicollis (Serville) Plate XII, figure 6.

1839. *Blatta fissicollis* Serville, Hist. Nat. Ins., Orth., p. 85. [♀, Cayenne, [= French Guiana].]

St. Laurent du Maroni, French Guiana, 1 ♂.

La Forestière, upper Maroni River, French Guiana, 1 ♂, 3 ♀.

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Depth of pronotal fissure	Length of tegmen	Width of tegmen
♂						
St. Laurent	33.5	10.7	18.	3.1	31.8	15.2
La Forestière	39.7	11.9	20.	3.9	34.7	17.
♀						
La Forestière	38.	11.	18.7	3.6	32.7	16.
La Forestière	38.	11.1	19.7	3.7	33.	16.7
La Forestière	39.8	11.7	20.	3.7	33.8	16.9

This very remarkable insect was previously known from the type and a single specimen, sent Guérin by Poey from Havana, Cuba. The latter specimen, with certain others recorded by Guérin,¹⁶ almost certainly came from South America and was included in the Cuban list in error.

Three immature individuals are before us from the same locality and one from Cayenne, taken in April, 1906, which we believe represent this species. The largest, apparently in the last stage preceding maturity, like the others, shows no trace of lateral pronotal fission and is in shape strongly flattened patelliform.

Zetobora emarginata Burmeister. Plate XII, figures 11 and 12.

1838. *Z[etobora] emarginata* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 511, No. 5. [Pará, Brazil.]

1838. *Z[etobora] cicatricosa* Burmeister, *ibid.*, p. 511, No. 6. [Pará, Brazil.]

La Forestière, upper Maroni River, French Guiana, 1 ♂, 1 ♀.

St. Jean du Maroni, French Guiana, 1 ♂, 1 ♀.

Association of the sexes and comparison with a topotype in the Academy Collection and with the original description, furnish convincing evidence that Burmeister's *emarginata* represents the male and his *cicatricosa* the female of the same species. In this insect the female is slightly larger, with broader pronotum and tegmina than the male, the lateral angles of the pronotum subemarginate caudad, not minutely but distinctly emarginate as in the opposite sex.

Walker's *perspicua* is an unquestioned synonym, as indicated by Kirby. That author is, however, incorrect in placing *limbata* of Brunner under *emarginata* and it is by no means clear that he is justified in placing *rudis* of Walker in the same synonymy.

¹⁶ In Ramon de la Sagra, Hist. Cuba, Ins., (1857).

MEASUREMENTS (*in millimeters*).

	♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
La Forestière, French Guiana		23.2	6.	10.9	20.5	8.4
St. Jean du Maroni, French Guiana		21.	6.3	10.8	20.	8.
	♀					
La Forestière, French Guiana		22.6	6.7	12.3	20.2	9.
St. Jean du Maroni, French Guiana		23.	7.	12.1	20.	9.7
Pará, Brazil		22.6	6.9	11.8	19.6	9.

ZETOBORELLA new genus.

This genus is erected to include the smallest and one of the most remarkable species of those referable to the genus *Zetobora* and its allies.

In addition to the small size, the present genus is distinctive in the extremely transverse pronotum, with latero-caudal angles bi-emarginate, the caudal emargination being conspicuous. This shows a further development of the type found in *Zetobora emarginata* Burmeister. The pronotum has the cephalic margin very broadly convex, without being broadly though conspicuously reflexed, in the latter respect agreeing with species of *Tribonidium*. The pronotal surface is distinctive in being smooth and polished over its greater portion, the remaining areas impresso-punctate. The tegmina are suddenly emarginate mesad, when at rest leaving the lamellate lateral marginal portions of the third to sixth tergites exposed. The tegmina, though broad, are, as in *Tribonidium*, much narrower than in *Zetobora*.

Genotype.—*Zetoborella gemmicula* new species.

Generic Description. Size very small for the group, form broad, but with tegmina much narrower than in *Zetobora*. Head flat, with face broadly and shallowly concave, dorsal outline semicircular, width between the reduced eyes considerable. Ocelli represented by shallow but moderately large concavities. Distal joints of maxillary palpi very short, the last broad. Pronotum with cephalic margin very broadly convex, caudal margin transverse, latero-caudal angles bi-emarginate; surface weakly trilobate, showing very feeble reflection toward the lateral portions of the cephalic margin and none mesad, surface smooth and shining except latero-caudad and mesad toward the caudad margin, where it is impresso-punctate. Mesonotum impresso-punctulate in the exposed scutellar area. Tegmina and wings well developed, showing very slight reduction in the female sex. Tegmina with very broad and short marginal field, the scapular field narrowing suddenly and very strongly proximad, discoidal field with veins and numerous cross-veins mod-

erately irregular, the former radiating. Wings with costal veins almost obliterated beyond the elongate mediastine vein. Abdomen with first to sixth tergites lamellate produced laterad, the first with latero-caudal angles broadly rounded, the second to sixth with these angles produced caudad and sharply rounded, seventh tergite much narrower, eighth with very narrow caudal portion only exposed. Supra-anal plate sub-bilobate. Cerci small and moderately slender, with (9 or 10) joints strongly differentiated. Subgenital plate of male of the usual asymmetrical lobiform type, with two simple styles; of female ample, moderately emarginate at cercal bases, truncate distad. Limbs completely unarmed,¹⁷ lacking genicular or other spines, ventro-caudal margins of median and caudal femora supplied with well spaced hairs. Four proximal tarsal joints scarcely longer than distal joint, supplied with large pulvilli. Large arolia present between the simple, symmetrical tarsal claws.

Zetoborella gemmicula new species. Plate XIII, figures 1 and 2.

The shining surface, smooth and very transverse pronotum and emarginate tegmina, which leave the lateral portions of the dorsum of the abdomen exposed, give this beautiful little insect a very distinctive appearance.

Type: ♂; St. Jean du Maroni, French Guiana. April and May. [Paris Museum.]

In addition to the features discussed above, we note the following. Interocular width three times ocular depth. Fourth joint of maxillary palpi half as long as third, fifth joint three-quarters as long as third, greatly expanding, its greatest width equal to length of fourth joint.¹⁸ Pronotum extending well beyond head, with cucullation above head flattened, surface broadly concave before the two latero-caudal emarginations, the first of these very weak and lateral in position, the second decided and caudad in position, twice as long as broad, with angulate-emargination formed sharply rounded at slightly less than a right angle. Tegmina extending slightly beyond cercal apices.

Allotype: ♀; same data as type. [Paris Museum.]

Very similar to male, except as follows. Interocular width three and one-half times ocular depth. Maxillary palpi with fifth joint as long as third and wider than length of fourth. Pronotum slightly less strongly transverse, with latero-caudal emarginations less decided, so that the caudal emarginations have the angulate-emar-

¹⁷ In the specimens of *Tribonidium* here recorded the limbs are unarmed except the ventro-cephalic margin of the cephalic femora, which is supplied in distal portion with a row of minute, chaetiform spines, terminated by a single stout, though very small, distal spine. The metatarsus is equal in length to the distal tarsal joint.

¹⁸ Apparently somewhat variable, as in the allotype it is even wider.

gination formed more broadly rounded at more than a right angle. Tegmina extending almost to cercal apices.

Head shining blackish brown. Antennae blackish brown, with a very broad buff annulus (including ten to twelve joints) in distal portion. Pronotum shining blackish brown in caudal section and extending cephalad in median convexity above head, remaining portions transparent, tinged with warm buff, the caudal margins of this area transverse laterad, with what appears to be a blackish brown suffusion at the angles, due to the fact that there the blackish brown area extends slightly farther cephalad on the ventral surface than on the dorsal face, cephalic margin very finely blackish brown. Tegmina mummy brown, blackish brown when closed, translucent, except marginal field which is opaque. Wings transparent, tinged with mummy brown, this weak in radiate field. Dorsal surface of abdomen blackish brown, with lamellate lateral sections of second and third tergites warm buff in the female, this marking in the male the same for the third tergite, but reduced to a small spot on the second tergite.¹⁹ Limbs and ventral surface prouts brown, deepening to blackish brown toward the abdominal periphery, but with lamellate ventral portions of second and third tergites warm buff.

Length of body ♂ 14²⁰-13, ♀ 15; length of pronotum ♂ 3.8-3.7, ♀ 3.8; width of pronotum ♂ 7.2-7, ♀ 6.7; length of tegmen ♂ 11.8-12.7, ♀ 10.8; width of tegmen proximad ♂ 4.7-4.7, ♀ 4.4; width of tegmen distad ♂ 4-4, ♀ 3.7; width of tegminal marginal field ♂ 1.8-1.95, ♀ 1.8 mm.

The species is known from the described pair and a paratype male from St. Laurent du Maroni.²¹

Phortioeca nimbata (Burmeister) Plate XIII, figure 3.

1838. *Z[etobora] nimbata* Burmeister, Handb. Ent., II, Abth. II, Pt. 1, p.

511. [Pará, Brazil.]

La Forestière, upper Maroni River, French Guiana, 2♂, 1♀, 1 juv. ♀.

Nouveau Chantier, French Guiana, 2♂.

Pariacabo, French Guiana, 1 juv. ♂, 1 juv. ♀.

Charvein, French Guiana, 1 juv. ♀.

This species was placed by Saussure in what he considered the second division of the genus *Zetobora*, (*Phortioeca*). It unquestionably belongs to *Phortioeca* and not to *Zetobora* (as assigned by Kirby) This is shown by the type of pronotum, with section above head more distinctly cucullate, cephalic margin not broadly reflexed

¹⁹ The greater portion of this conspicuous pale marking is exposed when the tegmina are at rest, due to the sudden emargination of those organs.

²⁰ The measurements of the male type are given first.

²¹ An immature female from Tollinche, Maroni River, French Guiana, represents this or a related species.

and greater portion of surface granulate, not everywhere impresso-punctate. The present material agrees fully with Saussure's adequate description of his synonymous *Zetobora* (*Phortioeca*) *castanea*.

It is of interest to note that the measurements given by Burmeister of the body length of this and the two preceding species are in all cases considerably less than that of specimens subsequently, and apparently correctly, recorded as these species.

Length of body ♂ 20.7-23, ♀ 25; length of pronotum ♂ 6.2-6.8, ♀ 7.3; width of pronotum ♂ 9.7-10.3, ♀ 11.7; length of tegmen ♂ 20.2-21, ♀ 23; width of tegmen ♂ 7.8-8.7, ♀ 9.7 mm.

BLABERINAE.

Blaberus giganteus (Linnaeus)

1758. *B[latta] gigantea* Linnaeus, Syst. Nat., Ed. X, I, p. 424. [America.]

1802. *Blatta colossea* Illiger, Mag. Insektenkunde, I, p. 186. [Demerara, [= British Guiana].]

La Forestière, upper Maroni River, French Guiana, 1 large juv. ♂.
St. Jean du Maroni, French Guiana, 2 ♂, 1 ♀.

The above synonymy has been recently established by us.²² In the present specimens the width of the marginal field of the tegmina is: ♂ 7.2, ♀ 7.9 mm.

Eublaberus biolleyi (Rehn) Plate XIV, figure 3, 4, 5, 6 and 7.

1906. *Blaberus biolleyi* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 792, fig. 1. [♀; Reventazon River, plains of Santa Clara, Costa Rica.]

St. Jean du Maroni, French Guiana, 1 ♂, 1 ♀, 1 juv.

These specimens, like a female from Trinidad, in the Hebard Collection, differ from the type in having the pronotal markings fused to different degrees. Such is the individual variability in these markings that we feel confident that but one species is represented.²³ This species is clearly distinct from *E. posticus* (Erichson), but the other described species²⁴ can not be vouched for, until extensive series can be secured. The difficulty is that, at present, there is no means of telling whether the various conditions described, with pronotum more heavily marked and suffused, represent distinct species or, in some cases, merely manifestations of decided intensive coloration in individuals of the same species.

²² Trans. Am. Ent. Soc., XLVII, p. 148, (1921).

²³ We figure the pronotum of the specimens before us, to show the individual variability of these markings.

²⁴ In chronological order the species are; 1848 *posticus* (Erichson), 1857 *sulzeri* (Guérin), 1869 *femorata* (Scudder), 1894 *thoracica* (Saussure and Zehntner) (= *posticus*), 1894 *immacula* (Saussure and Zehntner), 1903 *distanti* (Kirby), 1906 *biolleyi* (Rehn).

The two specimens here recorded show marked size diversity. Length of body ♂ 41.5, ♀ 49; length of pronotum ♂ 11.3, ♀ 13.3; width of pronotum ♂ 16, ♀ 19.1, length of tegmen ♂ 40, ♀ 46; width of tegmen ♂ 15.7, ♀ 18 mm.

CORYDIINAE.

OULOPTERYX²⁵ new genus.

This genus of comparatively medium-small species is one of the most distinctive found in tropical South America.

Ocelli are absent, the pronotum is transversely strongly impressed just before the cephalic margin, the pronotum and tegmina are coriaceous and polished, thickly impresso-punctate, except distad on the tegmina and very weakly to well supplied with hairs, the wings are exceptionally large for the body bulk and have a large appendicular field, which is not only folded but curled into a tight roll when these organs are at rest, the ventral femoral margins are unarmed except for a single distal spine on the ventro-cephalic margin of the cephalic femora, while pulvilli and arolia are absent.

The curled tegmina show a further development of the type found in the Ectobine genus *Theganopteryx*. The more than usually coriaceous tegmina, particularly in one species, gives to the species a decidedly coleopteroid facies.

Taking all of the characters into consideration the genus appears to be an aberrant member of the Corydiinae, and we place it in linear arrangement after *Buboblatta* Hebard and before *Ceuthobiella*, here described, though showing a development from a very different stock.

Genotype.—*Oulopteryx meliponarum* new species.²⁶

Generic Description. Size medium small, form elongate elliptical. Head slightly longer than broad, supplied with a few scattered hairs, eyes well separated, ocelli absent, maxillary palpi rather short and heavy. Pronotum shining, coriaceous, with cephalic margin transverse, caudal margin very broadly and weakly convex, greatest width meso-cauded; surface heavily impresso-punctate and very weakly to well supplied with scattered hairs, with a strong transverse impression before the cephalic margin, the discal section irregularly bossed, the narrow lateral portion weakly reflexed. Tegmina fully developed in male, showing slight reduction in female, shining, moderately to decidedly coriaceous, with apex rather sharp-

²⁵ From οὐλο-πτερυξ, in allusion to the curled wings.

²⁶ Described on page 247.

ly rounded, surface heavily impresso-punctate, this disappearing meso-distad, without hairs or well supplied with hairs, discoidal sectors longitudinal; veins invisible except in certain lights, except in portion of dextral tegmen concealed when at rest, which is subchitinous. Wings very large in proportion to body bulk, costal veins not clubbed, discoidal and median vein forming an elongate acute ellipse, crossed by numerous transverse veinlets, an irregular network of veinlets distad in area between the unbranched ulnar, anal and first branch of the axillary vein; appendicular field with basal line rounded obtuse-angulate, length nearly equal to width in males, length distinctly less than width in females, this area folding and curling into a tight roll when at rest; radiate field folding fanwise. Dorsal surface of male abdomen with median segment specialized. Cerci short, flattened dorsad, lateral margins complete. Male subgenital plate symmetrical, with similar, unspecialized styles. Female subgenital plate valvular. Limbs with femora unarmed except as follows: cephalic femora with ventro-cephalic margin supplied distad with minute, piliform but well separated spines, or lacking these, with a single elongate heavy distal spine; median and caudal femora with a similar distal spine on both ventral margins. Tarsi pilose ventrad, lacking pulvilli, caudal metatarsus as long as combined length of succeeding joints. Tarsal claws delicate, symmetrical, unspecialized; arolia absent.

Oulopteryx dascilloides²⁷ new species. Plate XV, figures 5, 6.

This species, though congeneric, differs in many respects from *O. meliponarum*, with which it is compared on page 247.

The blackish brown, usually coriaceous pronotum and tegmina and general contour strongly resemble certain species of Coleoptera.

Type: ♂; Pariacabo, French Guiana. [Paris Museum.]

In addition to the characters given in the generic description, we note the following. Size smaller, form not as elongate as in *meliponarum*. Head somewhat shorter than in that species, very slightly longer than broad. Interocular space three-quarters width between antennal sockets. Maxillary palpi shorter than in *meliponarum*. Pronotum smaller, discal boss stronger and giving the pronotum a decidedly less flattened appearance. Tegmina extending beyond cercal apices, decidedly coriaceous, sutural and costal margins rather strongly oblique to rounded apex in distal third. Wings with rolls of folded appendicular field lying obliquely. Median segment rather strongly impressed meso-proximad, with a short transverse ridge mesad on each side, the impressed area invaded by a blunt angulation meso-caudad, with a heavy tuft of agglutinated hairs springing from the depression in front of that point, directed cephalad. Supra-anal plate with length approxi-

²⁷ In allusion to the superficial resemblance shown by this species to members of the coleopterous genus *Dascillus*.

mately equal to one-third basal width, lateral margins weakly concave and convergent to broadly rounded median portion, except in a very small area mesad where a small rounded production occurs, the surface of this concave, the entire distal margin well supplied with elongate hairs. Concealed genitalia not visible in this specimen. Subgenital plate nearly symmetrical, the lateral margins convergent, the sinistral very feebly convex, then as feebly concave, the dextral as feebly concave to the style sockets, between these the distal margin is roughly broadly convex, weakly oblique in proximal portions, mesad truncate but when seen in caudal aspect as weakly obtuse-angulate ventrad, the angles formed all rounded. Styles similar, simple, straight, cylindrical, rounded at apex, each about two and one-half times as long as its width, slightly over one-quarter as long as the distance between the style bases. Limbs very slightly heavier and shorter than in *meliponarum*. Cephalic femora with ventro-cephalic margin supplied distad with a very few, minute, piliform spines, which are scarcely distinguishable, terminated by a single elongate distal spine. Caudal metatarsus equal to combined length of the succeeding tarsal joints.

General coloration shining blackish chestnut brown, paling to hazel along costal margin. Tegmina, when held against light, chestnut brown paling to hazel along costal margin. Wings transparent, almost colorless, veins buffy, costal veins distad opaque, ochraceous-buff. Dorsal surface of mesonotum, metanotum and abdomen buffy, the latter suffused with blackish chestnut brown laterad and in broad distal portion. Head shining blackish chestnut brown,²⁸ mouthparts and limbs mars brown, coxae and abdomen, except proximo-mesad where it is slightly paler, blackish chestnut brown.

Length of body 7.7, length of pronotum 2.2, width of pronotum 2.9, length of tegmen 7.1, width of tegmen 2.7, length of caudal tibia 2.4 mm.

The type is unique.

Latindia dohrniana Saussure and Zehntner.

1894. *Latindia dohrniana* Saussure and Zehntner, Biol. Cent.-Am., Orth., I, p. 111, pl. V, fig. 7. [♀, Guatemala.]

St. Jean du Maroni, French Guiana, 1 ♀.

Previously known from tropical Mexico to Panama, an additional female from Trinidad is before us.²⁹ The pronotal proportions of these two specimens are identical, length 1.8, width 2.05 mm.

Sphecophila polybiarum (Shelford)

1907. *Sphecophila polybiarum* Shelford, Trans. Ent. Soc. London, 1906, p. 518. [♂; Sainte Marie, Oyapock [River], French Guiana.]

²⁸ The antennae are missing.

²⁹ Recorded by Bruner as *L. castanea* Brunner (Jour. N. Y. Ent. Soc., XIV, p. 143, (1906).), which name is very possibly a synonym, as Brunner's pronotal measurements for the female type from Balthazar, Granada, (length 1.5, width 1.3 mm.), alone disagree and may easily be incorrect.

Sainte Marie, lower Oyapock River, French Guiana, 1900, (F. Geay; in nest of wasp, *Polybia pygmaea* Fabricius), 1 ♂, 4 juv., topotypes, taken with type.

It would appear that fifteen specimens in all were secured from the same nest, eleven of them being adult males.

Holocompsa nitidula (Fabricius)

1781. *B[latta] nitidula* Fabricius, Spec. Ins., I, p. 345, [[♀], Surinam.]

Demerara, British Guiana, 1901, (R. J. Crew), 4 ♂, 4 ♀, [Hebard Cln.]

St. Georges, Oyapock River, French Guiana, 1 ♂.

OXYHALOINAE.

Chorisoneura lata Rehn.

1916. *Chorisoneura lata* Rehn, Trans. Am. Ent. Soc., XLII, p. 253, pl. XV, figs. 28 to 30. [♂; Pará, Brazil.]

Gourdonville, French Guiana, 1 ♀.

This specimen is more intensively colored than the type. In this genus, which includes a multitude of species, often very closely related, we believe the present association to be correct, though it is impossible to be certain without males from the same locality.

In the male type of *lata*, the head coloration is destroyed, traces of a paler band between the eyes and a pair of dark flecks alone being discernible. In the female at hand the head coloration is apparently as it would be in the type, had its coloration been retained. Head with occiput ochraceous-tawny, terminating in a straight line between the eyes, upon which are situated two slightly impressed dots of dark brown, below this is a band of buff which widens slightly laterad, in that portion having a larger impressed dot of dark brown on each side, below this band the face is pale ochraceous-tawny.

Compared with *C. panamae* Hebard, this cephalic marking is seen to differ principally in having the more widely separated pair of dots, the larger and the pale areas confined to a transverse band instead of spreading ventrad over the face.

Chorisoneura guianae new species. Plate XIV, figures 11 and 12.

This species is closely related to *C. lata* Rehn,³⁰ differing in its

³⁰ Referred to the Pellucida Group by Hebard, Mem. Am. Ent. Soc., No. 4, p. 127, (1920). In addition to the species assigned to that group, *C. poststriga* (Walker) also apparently belongs. From the description of that species it may be distinguished from the present by the dark face and differently colored tegmina.

very slightly smaller size, distinctive and unspotted cephalic marking, pronotum with disk proportionately smaller when compared with the ample lateral portions and tegmina with venation broadly pale in all portions, so that the small remaining darker areas give these organs a delicately tessellate appearance.

Type: ♂; Bartica, British Guiana. April 14, 1913. (H. S. Parish.) [Acad. Nat. Sci. Phila., Type no. 537.]

Size rather large for the genus, form depressed, in outline elongate elliptico-ovoid. Head broad, decidedly depressed; from the dorsum practically the entire occiput and cephalic half of the eyes are seen to be exposed, occipital outline truncate, the eyes almost imperceptibly projecting beyond the interocular area; interocular space broad (.6 mm.), one and one-half times occipital ocular depth, about four-fifths as wide as space between antennal sockets. Maxillary palpi with third joint elongate and slender; fourth joint three-quarters as long as third; fifth joint slightly longer than fourth, moderately enlarged. Pronotum transverse elliptical, with a marked rectangulate tendency, due to the wide and strongly transverse cephalic and caudal margins, cephalic margin showing a trace of convexity only above the head, caudal margin showing a very feeble convexity, lateral margins broadly convex, rounding evenly into cephalic and caudal margins; greatest width mesad; disk with a shallow medio-longitudinal impression and a pair of brief oblique sulci laterad, very slightly but appreciably smaller in proportion to lateral portions than in *lata*; lateral portions weakly declivent cephalad, where the surfaces are very shallowly concave, weakly bossed over tegmina. Tegmina elongate, extending briefly beyond cercal bases, greatest width at proximal third, thence narrowing evenly to near the sharply rounded but acute apex; marginal field very broad; costal veins (17) with a number of false veinlets between, discoidal sectors (16) strongly oblique. Wings with intercalated triangle forming an angle of appreciably less than ninety degrees. Sixth abdominal tergite with a very shallow round depression mesad, rather thickly supplied with minute agglutinated hairs. Supra-anal plate damaged in this specimen. Subgenital plate with flattened bases of the shallowly inset styles occupying almost all of free margin; styles very elongate, nearly three times as long as basal width, broad at base, tapering to the lamellate and rather sharply rounded apices, unarmed on external surfaces. Between the styles the median portion of the plate is produced in a very slender, chitinous shaft, three-quarters as long as one of the styles, showing a very slight and even curvature caudad throughout its length and tapering to the aciculate apex. Limbs and their armament, tarsi, claws, pulvilli and arolia as characteristic of the genus.

Allotype: ♀; same data as type, except taken December 11, 1912. [Acad. Nat. Sci. Phila.]

Agrees closely with type. Tegmina slightly shorter. Interocular space slightly wider. Supra-anal plate triangularly produced, strongly notched at apex, this rounded emarginate, deeper than wide, the two sharply rounded portions thus formed with surfaces moderately convex, lateral margins feebly concave. Subgenital plate ample, narrow distal portion reflexed, longitudinally cleft mesad.

Head with vertex to point of least width between eyes auburn, the line of demarcation there sharp, weakly convex dorsad in male, transverse in female, face whitish buffy shading to ochraceous-buff ventrad. Antennae in males mummy brown in proximal fourth, thence much paler, buckthorn brown, in female pale buckthorn brown throughout. Pronotum with marginal portions transparent, very faintly tinged with ochraceous-buff; disk tawny, mesad with a pair of small, parallel, longitudinal markings of ochraceous-buff. In the female the disk is russet laterad, the area between and about these markings alone tawny. Tegmina transparent, marginal field and along costal margin very faintly tinged with ochraceous-buff, the veins and veinlets in the other portions (except the humeral trunk for a brief distance proximad, where it is ochraceous-tawny) all broadly defined in this color, the very small intervening areas in these portions weakly tinged with ochraceous-tawny, this giving the tegmina a delicately tessellate appearance. Wings transparent very faintly tinged with buff, except in proximal portion of costal veins (strongly tinged with prouts brown in this area in the intensively colored allotype) and about the intercalated triangle, where they are weakly tinged with ochraceous-tawny, the enlarged (distal) portions of the costal veins whitish. Limbs ochraceous-buff. Ventral surface pale ochraceous-buff, showing a whitish bloom.

MEASUREMENTS (*in millimeters*).

		Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
♂						
Bartica, British Guiana, <i>type</i>		11.	2.2	3.5	9.8	3.
Cayenne, French Guiana, <i>paratype</i>		10.7	2.2	3.55	10.	3.15
♀						
Bartica, British Guiana, <i>allotype</i>		10.6	2.3	3.6	9.3	3.

In addition to the described pair, a paratypic male from Cayenne, French Guiana, property of the Paris Museum, has been examined.

Chorisonera barticae new species. Plate XIV, figure 13.

This insect may be distinguished from the multitude of related species by the small size (tegmina length 8 mm. or less), the distinctively marked head, nearly unicolorous pronotum, which is obscurely paler mesad, unicolorous tegmina except for the paler margins and male styles, which are developed as foliaceous plates taper-

ing distad to their acute apices and less than twice as long as broad, between the bases of which the subgenital plate is triangularly produced and unarmed.

To the known Panamanian species it will be seen that nearest affinity is with *C. cabimae* Hebard, that species differing in the marking of the head, wider interocular space, very much more elongate fourth joint of maxillary palpi and differently shaped male styles.

Type: ♂; Bartica, British Guiana, January 10, 1913. [H. S. Parish.] [Acad. Nat. Sci. Phila. Type no. 5370.]

Size medium for the small species of the genus; form depressed, surface glabrous. Head with occiput largely exposed. Interocular space (.45 mm., in *cabimae* .55 mm.) two-thirds the width between the antennal sockets. Maxillary palpi with fifth joint slightly shorter than fourth, fourth joint approximately four-fifths as long as third. Pronotum transverse, subelliptical; greatest width meso-caudad; cephalic and caudal margins transverse, feebly convex; latero-cephalic angles distinctly more broadly rounded than latero-caudal angles. Tegmina surpassing apex of abdomen by about the pronotal length, strongly elongate lanceolate, with apex sharply rounded, distinctly more acute than in *cabimae*; discoidal vein with numerous branches, the more distal of which are subobsolete; discoidal sectors (9) oblique. Wings and venation very delicate; appendicular field nearly as long as broad, basal outline forming very slightly more than a right angle; costal veins moderately heavily clubbed distad. Dorsal surface of abdomen with sixth segment weakly specialized mesad, as characteristic of the genus. Supra-anal plate strongly transverse, very weakly triangularly produced. Subgenital plate with lateral portion of free margin weakly oblique, nearly transverse, straight to the two short styles, which are deeply inset, between these the subgenital plate is minutely triangularly produced and unarmed. Styles heavy, nearly twice as long as greatest width near base,³¹ the lateral margins from that point to the small apical portion, which is formed by a folding over of the style, forming a small triangular apex, directed dorso-laterad. Limbs and their armament, pulvilli, tarsal claws and arolia as characteristic of genus.³²

Allotype: ♀; same data as type, except taken on January 30, 1913. [Acad. Nat. Sci. Phila.]

Agrees closely with male, differing in the following features. Interocular space broader (.65 mm.). Tegmina slightly less elongate. Dorsal surface of abdomen not specialized. Supra-anal plate triangular and rather strongly produced, with lateral margins

³¹ In the male paratype these styles are distinctly shorter than in the type, with contour, however, similar.

³² Fully described, Mem. Am. Ent. Soc., No. 4, p. 135, (1920).

broadly concave to the narrowly bilobate apex, the area intervening between these lobes forming an angle as deep as its basal width, with lateral margins weakly concave. Subgenital plate scoop-shaped, with marginal convexity greatest latero-caudad, distal portion sharply reflexed, broad mesad, with a medio-longitudinal cleft, this reflexed portion narrowing rather strongly to opposite cercal bases, where it disappears.

Head with vertex to between ocellar areas ochraceous-tawny, there this area of coloration is terminated by a very fine, transverse line of mummy brown, below which the face is entirely pale ochraceous-buff and likewise opaque,³³ antennae and mouthparts weakly tinged with translucent ochraceous-buff. Pronotum with marginal portions transparent, faintly tinged with ochraceous-buff; disk ochraceous-tawny, in some examples paling mesad to ochraceous-buff tinged with ochraceous-tawny, this more extensive caudad. Tegmina transparent evenly and weakly tinged with ochraceous-buff. Wings transparent, with a very faint buffy tinge, this becoming stronger in the area of the costal veins and showing a very weak tawny suffusion about the intercalated triangle. Dorsal surface of abdomen ochraceous-buff, faintly tinged with ochraceous-tawny. Limbs ochraceous-buff. Ventral surface pale ochraceous-buff, in the best preserved specimens showing the same opaque whitish condition as found on the face.

MEASUREMENTS (*in millimeters*).

		Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
♂						
Bartica, British Guiana, <i>type</i>		9.34	1.8	2.8	8.1	2.7
Bartica, British Guiana, <i>paratype</i>		8.	1.8	2.85	8.	2.7
♀						
Bartica, British Guiana, <i>allotype</i>		8.	1.85	2.9	7.8	2.8
Bartica, British Guiana, <i>paratype</i>		9.34	1.8	2.9	7.8	2.75
Demerara, British Guiana, <i>paratype</i>	34		1.8	2.85	7.8	2.75

Specimens Examined: 5; 2 males and 3 females.

Bartica, British Guiana, I, 10 to 30, 1913, (H. S. Parish), 2 ♂, 2 ♀, *type*, *allotype* and *paratypes*, [A. N. S. P.].

Demerara, British Guiana, 1901, (R. J. Crew,) 1 ♀,³⁵[Hebard Cln.]

Section II. SOUTHEASTERN BRAZIL.

This collection is of particular interest, due to the fact that it is

³³ Specimens of the genus, in drying, apparently often lose this whitish pigmentation, these areas in such becoming translucent weakly tinged with ochraceous-buff. In such specimens, however, the areas originally more strikingly defined are usually detected with little difficulty.

³⁴ Abdomen squeezed out, in life probably about 8 mm. in total length.

³⁵ Recorded by Rehn as *Chorisoneura gracilis* (Saussure), Proc. Acad. Nat. Sci. Phila., 1906, p. 271, (1906).

in large part from the vicinity of Rio de Janeiro, type locality of many of the older species described from South America.

As a result, the present study has aided greatly in clearing up the identity of a number of older names. Several of these are of great importance in that they represent genotypic species. Such are; *Neoblattella adpersicollis*, *Liosilpha pumicata*, *Phoraspis picta*, *Petasodes mouffeti*, *Monastria biguttata*, *Brachycola tuberculata* and *Parahormetica bilobata*.

The 155 specimens treated, represent 27 genera and 38 species, of which 3 genera and 9 species are new.

Among the new species described, *Dasyblatta thaumasia* from Pará, and *Oulopteryx meliponarum* from near Passa-Quatro, Minas Geraes, represent extremely unusual types. The latter species is of additional interest, in being the first Blattid known to be symbiotic with bees.

ECTOBIINAE.

Anaplecta bivittata Brunner.

1865. *A [naplecta] bivittata* Brunner, Nouv. Syst. Blatt., p. 63. [♀, Brazil.]

Tijuca, Rio de Janeiro, Brazil, 800 to 900 meters, 1 ♂.

Though in a poor state of preservation, the present specimen is seen to agree closely with a male, previously recorded by Rehn, from Pará, Brazil. The squarely truncate tegminal maculation is a striking feature of coloration in the species. Slightly darker transverse suffusions across the face, suggested in these specimens, may prove to be a more conspicuous feature of coloration in better preserved material. Length of body 5.6, length of tegmen 5.3 mm.

Anaplecta xanthopeltis new species. Plate IX, figures 1 and 2.

This insect appears to be closely related to *A. fusca* Shelford, described from a unique female from Cachabi, Ecuador. The present male differs from the description of that species in the larger size, pale head and pronotum and in features of wing venation.

In the present specimen the interval between the discoidal vein and its branch caudad³⁶ is wider and is crossed by three transverse veinlets, this area being very weakly defined distad, the branching

³⁶ In Shelford's description of *fusca* termed the "medio-discal" field, though the area so termed elsewhere and designated as the medio-discoidal field by us, is shown by that author's figure of *fusca* to be the area caudad of that to which he has referred.

of the axillary vein is regular, while the anal vein in the appendicular field curves strongly toward the caudad margin distad.

The male of *fusca* will probably show other differences of more diagnostic value than those of the wing venation.

Type: ♂; Rio Itaya, Peru.³⁷ February. [Paris Museum.]

Size small for the genus of very small species, form relatively moderately slender, coleopteroid. Head distinctly longer than broad, with no distinct ridge above ocellar areas, ocellar spots subobsolete.³⁸ Pronotum almost perfectly oval, surface weakly convex. Tegmina comparatively narrow, rather strongly chitinous, venation inconspicuous, costal margin very feebly convex proximad, thence nearly straight to distal portion, where it is oblique and more markedly convex to the acute-angulate though bluntly rounded apex, this apex situated beyond the axis of the tegmen toward the sutural margin. Wings very elongate and narrow, over twice as long as greatest width, costal veins (five) straight and scarcely thickened distad, medio-discoidal area with two transverse veinlets, the more distal heavy and appearing as a gradual curvature of the discoidal vein to join the median vein, this veinlet sending three veinlets distad; appendicular field in length slightly over two-fifths that of remaining portion of wing, length equal to width. Supra-anal plate with free margin broadly convex, about twice as wide as long; dorsal surface with a delicate transverse ridge mesad, which bears mesad on its cephalic face a tuft of microscopic hairs, cephalad of which it is concave, the caudal margin of the preceding tergite being roundly emarginate about this concavity. Subgenital plate simple, bearing two very minute, short, simple, conical styles. Limbs and their armament, tarsal claws and arolia as characteristic of genus.

Head light ochraceous-tawny, suffused with mummy brown laterad above the clypeus, maxillary palpi dresden brown, with distal joints deepening to mummy brown. Antennae deep dresden brown. Pronotum with disk immaculate light ochraceous-tawny, lateral portions transparent, tinged with buff. Tegmina deep chestnut brown, except the narrow marginal field, which is transparent, tinged with buff. Wings tinged with mummy brown, this weak proximad, very heavy in distal portion of anterior field and anterior portion of radiate field. Ventral surface of abdomen buffy brown mesad, shading to prouts brown laterad. Limbs and cerci ochraceous-buff, the cephalic tibiae and tarsi weakly suffused with brown.

Length of body 5, length of pronotum 1.2, width of pronotum 1.6, length of tegmen 3.9, width of tegmen 1.3 mm.

³⁷ We describe this species here, as it is one of the two new species in the Paris Museum collection from Peru, both of which are indeed representatives of the fauna of the upper Amazonian drainage.

³⁸ Possibly due to discoloration.

The type of this handsome, though plainly bicolored species, is unique.

DASYBLATTA³⁹ new genus

This genus is erected to include two anomalous species, *thaumasia*, described on page 225, and *chopardi*, described on page 257, apparently referable to the Group Blattellae, but exceptionally distinctive in being clothed with microscopic hairs and in having the intercalated triangle curled and tubuliform when at rest.⁴⁰

The insect further shows decided similarity to some of the smaller species of the genus *Ischnoptera*, belonging to the Group Ischnopterae, in the general contour, and particularly that of the head and pronotum.

In linear position we place *Dasyblatta* after *Platylestes* and before *Chromatonotus*, no close relationship to any previously described genus, however, being indicated.

Genotype.—*Dasyblatta thaumasia* new species.

Generic Description. Based on the male sex. Size small, form slender, structure not as delicate as is usual in the Group, entire surface, when tegmina are closed, decidedly hairy. Interocular space rather broad to decidedly narrow; ocelli distinct, with flat surfaces of ocellar areas forming a rather sharp angle with the interocellar space. Eyes extending ventrad nearly to maxillary palpi. Maxillary palpi comparatively short, with fifth segment longest of all. Pronotum moderately convex, laterad decidedly so to the very narrowly concave lateral portions, disk with two broad but distinct sulcations mesad, which converge caudad; cephalic margin transverse, much broader caudal margin weakly convex, point of greatest width meso-caudad. Tegmina and wings fully developed. Tegmina hirsute, anal field very elongate, discoidal sectors longitudinal.⁴¹ Wing with costal veins not enlarged, discoidal and unbranched median vein connected by numerous transverse veinlets; ulnar vein with (1) complete branch, showing numerous transverse veinlets and very numerous bases of these toward fold of the wing, intercalated triangle very broad and conspicuous, curling in a tube when the wings are at rest. Dorsal surface of abdomen unspecialized. Subgenital plate with a process sinistro-proximad, which lies outside of, and alongside, the cercal base. Limbs heavy for the group. Ventro-cephalic margin of cephalic femora armed with a

³⁹ From δασύ-βλαττα = A hairy cochroach.

⁴⁰ In these features only, agreement with the genus *Oulopteryx*, described in the present paper and assigned to the Corydiinae, is shown. The ensemble of characters, however, leads us to believe that the present genus is a member of the Pseudomopinae.

⁴¹ In the specimen described as *D. chopardi* on page 257, the discoidal sectors of the dextral tegmen toward the sutural margin are, however, moderately oblique.

few well-spaced, heavy spines, succeeded by a row of (15-17) minute chaetiform spines, terminating in three heavy spines, very elongate, in increasing ratio distad. Ventro-caudal margin of cephalic femora armed with (1 median, 1 subdistal and 1 distal) heavy, elongate spines. Other femoral margins well supplied with heavy elongate spines. Four proximal tarsal joints supplied distad with minute, simple pulvilli. Tarsal claws simple, symmetrical. Very small arolia present.

Dasyblatta thaumasia new species. Plate IX, figures 9, 10 and 11.

The many astonishing characters of this insect are discussed in the generic treatment. The male sex only is known.

Type: ♂; Pará, Pará, Brazil. (C. F. Baker.) [Acad. Nat. Sci. Phila., Type no. 5377.]

In addition to the characters given in the generic description, the following are noteworthy. Interocular space slightly over one-quarter occipital ocular depth, about one-third width between antennal sockets; impressed punctae, the sockets of hairs, particularly conspicuous in the inter-ocular-ocellar area. Third joint of maxillary palpi slightly shorter than the large fifth joint, slightly longer than the fourth joint. The hirsute tegmina have, to the naked eye, a coriaceous appearance, due to the fact that the hairs are not visible except under the microscope; area of dextral tegmen, concealed when at rest, without hairs; discoidal sectors (8 and 9) longitudinal. Wings with distal portion of anterior margin hirsute. Metanotum with a minute subchitinous projection mesad on the caudal margin, which is twice as long as broad; large and very decided rounded ridges diverge from this across the median segment, terminating before the latero-caudal portions of that segment. Seven proximal tergites with latero-caudal angles rectangulate and sharply rounded. Eighth tergite narrowly visible, normal dextrad but with sinistral folded portion (including the latero-caudal angle) strongly produced beside the super-anal plate to near the cercal base. Supra-anal plate two-thirds as long as proximal width, weakly chitinous in distal portion; lateral margins straight, parallel, to bases of cerci, straight and strongly oblique to within these, the remaining portion roundly produced, showing a weak indication of a symmetrical, trapezoidal contour. Springing from the sinistral base of the subgenital plate and from within the production of the eighth tergite, a straight, cylindrical, chitinous process extends caudad along the outer margin of the cercus nearly as far as does the supra-anal plate, this process six times as long as thick, with apex moderately enlarged and bearing a cluster of elongate, straight, chaetiform spines. Subgenital plate with all but base of sinistral portion curled upward to just within and beneath sinistral cercus, bearing on its internal surface a stout conical projection which terminates in several adjacent, very elongate chaetiform spines, directed mesad, the margin of this portion weakly curved,

rounding at its extremity, then declivent to the not upcurled median portion of the plate, the median section of the margin undulate, bearing in its median depression a small, cylindrical process (sinistral style) slightly longer than wide, directed dorsad and armed with two sharp, slender spines, which curve weakly sinistrad; bearing in its dextral depression a much more elongate process (dextral style) which is sinuous, directed dorso-mesad and terminating in a sharp, slender spine; beyond the dextral, portion of the plate is strongly curled upward and inward, overhanging the dextral style and folded beneath the cercal base, its margin broadly convex.

Head with occiput to above ocelli auburn, ocelli light buff; remaining portions, including proximal antennal joints and palpi, ochraceous-buff with a tawny tinge, with twin weak suffusions of auburn between the antennal sockets. Remaining portions of antennae dresden brown. Pronotum cinnamon brown with a very faintly paler, subobsolete medio-longitudinal line and flecks, lateral portions very narrowly ochraceous-buff with a tinge of buckthorn brown. Tegmina translucent buckthorn brown, very brief marginal field ochraceous-buff with a tinge of buckthorn brown, humeral trunk and between humeral and very brief mediastine vein, cinnamon-brown for a very short distance. Wings transparent, faintly tinged with brown, except in area of costal veins, where they are heavily tinged with dresden brown. Dorsal surface of abdomen buckthorn brown, mottled with cinnamon brown. Limbs pale orange-yellow, ventral surface of abdomen ochraceous-buff tinged with orange.

Length of body 10.8, length of pronotum 2.7, width of pronotum 3.3, length of tegmen 10.9, width of tegmen 3.3, length of caudal tibia 4.2, length of caudal metatarsus 1.9 mm.

This diminutive and commonplace looking insect is one of the most highly specialized and distinctive forms of the Blattidae known to us. The type is unique.

Supella supellectilium (Serville)

1839. *Blatta supellectilium* Serville Hist. Nat. Ins., Orth., p. 114. [Mauritius.]

Bahia, Brazil, 1 ♂, 1 ♀.

Neoblattella janeirae new species. Plate IX, figures 17, 18 and 19.

Though showing the general structure and color pattern of several of the larger groups of this genus, this species differs from all others known to us in the armament of the cephalic femora. The ventro-cephalic margin of these members is armed with a row of heavy spines which decrease suddenly in size and length mesad, those distad being very minute and closely placed, but too heavy to be termed piliform. This is seen to agree more closely with the type

termed "A," than with type "B," the latter the characteristic armament for the other species of *Neoblattella*.

We do not feel warranted in considering this species generically distinct solely on this condition; in numerous other characters *janeirae* shows much closer affinity to the *Conspersa* Group than to the genotypic *Adspersicollis* and other Groups of the genus.

The very narrow interocular space and symmetrically highly specialized male subgenital plate constitute particularly distinctive features. The proportionately decided amplitude of the organs of flight is only exceeded in males of *N. carrikeri* Hebard, of the species at hand.

Though simply and not strikingly colored, this is one of the most interesting species of the genus, due to the unusual armament of the cephalic femora and remarkable specialization of the male supra-anal plate.

Type: ♂; Tijuca, Rio de Janeiro, Brazil. Elevation 500 to 1000 meters. May. [Paris Museum.]

Size medium for the genus, form moderately slender. Interocular space comparatively narrow, one-third that between the antennal sockets. Ocellar spots distinct, their surfaces oblique to, but rounding smoothly into, the flattened inter-ocular-ocellar area. Maxillary palpi elongate. Pronotum with surface very weakly convex, greatest width distinctly caudad of median point, caudal margin showing an exceedingly broad and rounded, feeble obtuse-angulate production. Tegmina delicate and elongate with (10 sinistral, 11 dextral) longitudinal discoidal sectors; cross-veinlets distinct, particularly in distal portion, where they are darkened. Wings with mediastine vein and (7) proximal costal veins showing elongate thickened distal portions, ulnar vein with (6)⁴² complete branches, intercalated triangle well developed, its width over one-half its length. Dorsal surface of abdomen without distinct specialization, but with meso-caudal section of sixth tergite subchitinous in an irregularly triangular area, extending over half the distance to base of the tergite, the sides of which area are concave. Supra-anal plate two-fifths as long as basal width, very bluntly triangularly produced, with apex broadly sub-bilobate and lateral margins showing very broad and feeble concavity opposite the cercal bases. Concealed genitalia hidden. Subgenital plate ample, symmetrical, very deeply cleft on each side, the lateral portions thus separated, nearly vertical, elongate and very slenderly triangular plates curling outward to their blunt, rounded apices, which extend slightly further caudad than the median production

⁴² Two of these branches again divide in the type.

of the plate; that portion weakly chitinous, roundly produced, leaving a very deep, narrow cleft on each side between it and the lateral portions, showing a blunt but decided medio-longitudinal carina extending to its small apical portion, which portion is suddenly directed cephalad, its surface flat, its lateral margins cutting in at the base so that, with the lateral margins of the basal portion, very small but moderately deep concavities are formed. From the bases of the very deep lateral clefts of the subgenital plate spring similar, simple, elongate, straight and nearly cylindrical styles, which, lying in these clefts between the median portion and the lateral portions, extend half the distance to the apices of the lateral portions of the plate, each about five times as long as its proximal width. Cephalic femora with ventro-cephalic margin armed with (4) large, elongate, moderately heavy, well-spaced spines, succeeded by a row of (18) very minute but moderately stout spinulae, terminated by three⁴³ large, moderately heavy spines, elongate in increasing ratio distad; ventro-caudal margin armed with (3 and 1 distal) spines. Other femoral margins armed with spines, as characteristic of the genus. Caudal metatarsus very elongate and slender, nearly twice as long as the combined length of the succeeding tarsal joints. Pulvilli on four proximal tarsal joints small, acute-angulate produced. Tarsal claws symmetrical, the moderately well-developed flange margined with very minute teeth. Arolia between the tarsal claws moderately well developed.

General coloration buckthorn brown. Head with occiput ochraceous-buff, with suffused vertical streaks of prouts brown; a broad band of prouts brown between the eyes; ocelli and inter-ocular-ocellar area ochraceous-buff, this extending over face, but weaker and more embrowned ventrad, a small fleck of prouts brown below each ocellar spot, four similar flecks below which are placed in a transverse line showing convexity ventrad, area below antennal sockets suffused with prouts brown, with a fleck of prouts brown on each side meso-ventrad. Antennae clay color. Pronotum transparent, faintly tinged with brown laterad; disk ochraceous-buff, heavily though finely pictured with lines and dots of prouts brown. Tegmina transparent, faintly tinged with brown, except distad and in area of dextral tegmen concealed when at rest where the tinge is darker, mummy brown, this very heavy and blackish

⁴³ A correction for this character for *Neoblattella*, as given by us in our key, is necessary, (Mem. Am. Ent. Soc., No. 4, p. 28, (1921).). We find that three heavier distal spines occur in all of the species of the genus before us excepting *eudromielloides*, *berlandi* and the numerous species of the *Impar* Group, in which but two heavier distal spines are shown. In some species virtually an intermediate condition is reached, the first of the three distal spines being sufficiently reduced so that it would be counted by some and regarded as one of the series of smaller spines by others. Of the Group *Blattellae*, *Neoblattella* is much the largest American genus and it is to be expected that much more decided differences will be found between some of its component groups and species than occur in any of the related genera.

in the inner portion of the area concealed when at rest, the distal veins and veinlets more strongly defined in mummy brown. Wings transparent, faintly tinged with mummy brown, this heavier distad and in area of costal veins; clubbed portions of costal veins opaque, mummy brown. Mesonotum and metanotum prouts brown with a medio-longitudinal line of whitish, which on each segment expands caudad. Dorsal surface of abdomen clear cinnamon-buff, each segment very heavily suffused with mummy brown lateral. Underparts clear cinnamon-buff, suffused with prouts brown laterad; abdomen with flecks of this color laterad and with a medio-longitudinal suffusion of blackish brown, which expands caudad to include the entire subgenital plate.

Length of body 13.8, length of pronotum 3.3, width of pronotum 4.8, length of tegmen 16.2, width of tegmen 4.9, length of wing 14.8, width of wing 8.7, width of intercalated triangle 1.8, length of tibia 6.2, length of caudal metatarsus 2.9 mm.

The type of this remarkable species is unique.

Neoblattella platystylata new species. Plate IX, figures 21, 22 and 23; Plate X, figure 1.

Closely related to *N. conspersa* (Brunner), the present species agrees in general structure, minute and scattered tegminal dots and general character of specialization of the subgenital plate in both sexes, (figured for *conspersa*, plate IX, figure 20).

The styles of the male subgenital plate are much heavier, decidedly broader than long, while the production of the meso-caudal portion of that plate is much more sudden and pronounced, forming there a stout projection.

The female subgenital plate is specialized very much as described for *conspersa* on page 261; the inner projections, however, usually produced in but one or two stout spines.

Though the dark marking of the ventral surface of the abdomen is carried out broadly to the extremity of the subgenital plate in all of the males, the majority of the females have this marking narrower and in individuals of extreme recessive coloration it is greatly reduced, not reaching as far as the base of the subgenital plate.

As in *conspersa*, the number and intensity of the dark scattered tegminal dots is individually variable, as is the usually conspicuous pale band below the dark interocular band on the head.

Type: ♂; Igarapé-Assú, Pará, Brazil. (H. S. Parish.) [Acad. Nat. Sci. Phila., Type no. 5376.]

Size medium small for the genus, slightly larger than the average for *conspersa* from the same region, form moderately slender. In-

terocular space wide, slightly narrower than that between the antennal sockets. Ocellar spots distinct. Maxillary palpi elongate, fourth joint four-fifths as long as third, fifth very slightly shorter than fourth. Pronotum with surface very weakly convex, greatest width slightly caudad of mesal point. Tegmina very delicate, with (9) longitudinal discoidal sectors, veins with scattered dark dots, representing the bases of microscopic hairs; cross-veinlets moderately developed, moderately darkened in distal portions. Wings with costal veins heavily clubbed distad, ulnar vein with (3) complete branches, intercalated triangle small. Abdomen with dorsal surface unspecialized. Supra-anal plate weakly triangularly produced, about one-third as long as proximal width with apex broadly rounded. Concealed genitalia including a process terminating in a broad whorl, its surface covered with very closely placed, minute spines.⁴⁴ Subgenital plate convex and curled dorsad on each side, but broadly and shallowly concave in large median portion, distal margin approximately transverse, on each side produced in short, very broad, styles which fuse with the plate at their bases; between these the plate is produced mesad a nearly equal distance, the sides of this portion slanting upward and the free margins concave oblique to the apex; due to the contour of this production, its apex appears truncate in ventral aspect, but V-emarginate in caudal aspect. Each of the styles is nearly twice as broad as its greatest length, the greatest length being on the internal margin, the roundly truncate, broad apex being in consequence oblique to the caudal margin of the subgenital plate. The apices of these styles are moderately thickly supplied with minute but stout spines, directed caudad and curving ventrad. Limbs, their armament, pulvilli, arolia and tarsal claws as characteristic of the genus. The first three of the five or six microscopic teeth on the margin of the flange of the tarsal claws are relatively decided.

Allotype: ♀; same date as type. [Acad. Nat. Sci. Phila.]

Agrees closely with male in size and development of organs of flight, differing as follows. Supra-anal plate with free margin more convex and roundly notched at the apex. Subgenital plate short, scoop-shaped, bearing on each side just within the cerci a small lamellate projection, with truncate apex armed with (5 to 7 in the series) closely placed, chitinous spines, resembling the teeth of a comb; within at the base of this process is another projection⁴⁵ the

⁴⁴ The concealed genitalia in the species of this group appear to be very delicate. In the great majority of specimens before us these parts are mashed, and in none do they appear to have dried in a normal position.

⁴⁵ The series shows that these processes are variable in contour, as well as occasionally having more teeth and in themselves a very weak character to separate this sex of *platystylata* from the very similar females of *conspersa*. An average lesser number of teeth on the inner processes of females of *platystylata* from Pará has appeared to us to be a guide to distinguish them from females of *conspersa* from that locality. It is evident that females of the species of the present Group will be found as difficult to separate as those of the Impar Group of the genus; determination of female material, without males from the same locality, being often out of the question.

sinistral of these bearing a stout chitinous spine, the dextral armed with two spines.

General coloration buckthorn brown. Head of this color, a broad transverse band of cinnamon brown between the eyes, sharply delimited ventrad by a much narrower transverse band of cinnamon-buff between and including the ocellar spots, below this with a narrow marginal suffusion of cinnamon brown, which laterad runs down beside the antennal sockets, and another transverse suffusion of the same above the clypeus.⁴⁶ Pronotum with disk weak ochraceous-tawny, with the characteristic fine picturing of cinnamon brown, this sometimes very weak, occasionally much suffused; lateral portions transparent, very faintly tinged with brownish. Tegmina transparent, very faintly tinged with brownish, particularly along costal margin, the veins with minute scattered dots of prouts brown and with distal cross-veinlets slightly darkened except in recessive examples, where even the dots are considerably reduced in number. Underparts and limbs buckthorn brown, with flecks of prouts brown on the latter at bases of spines. Ventral surface of abdomen with a broad medio-longitudinal blackish band, broad on subgenital plate of male, narrow or failing to reach this portion in female.

MEASUREMENTS (*in millimeters*).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
Bartica, British Guiana (5)	10.7-11.3	2.6-2.8	3.2-3.4	10.7-11.3	3.2-3.3
St. Jean du Maroni, French Guiana (2)	9.2-10.5	2.7-2.8	3.4-3.6	11-11.3	3.2-3.3
Igarapé-Assu, Pará, Brazil, <i>type</i>	10.7	2.7	3.5	11.3	3.3
Igarapé-Assu, Pará, Brazil, <i>paratypes</i> (9)	9.3-11	2.4-2.8	3.3-3.8	10.7-12	3.1-3.7
♀					
Bartica, British Guiana (3)	10-10.2	2.8-2.8	3.7-3.8	10.9-11	3.2-3.2
St. Jean du Maroni, French Guiana	9.4	2.6	3.4	10.7	3.1
Igarapé-Assu, Pará, Brazil, <i>allotype</i>	10.	2.7	3.6	10.9	3.2
Igarapé-Assu, Pará, Brazil, <i>paratypes</i> (12)	9.6-11	2.7-3	3.3-3.8	10.8-11.7	3.2-3.6

These individuals are exceedingly delicate in structure, the manner in which the abdomen has dried having a marked effect upon the body length of the material preserved.

⁴⁶ These markings are heavier in intensive examples. As in *conspersa*, however, the interocellar pale band is always conspicuous except in discolored specimens.

Specimens Examined: 37; 18 males, 18 females, 1 immature individual.

Bartica, British Guiana, XII, 19, 1912 to III, 15, 1913, (H. S. Parish), 5 ♂, 3 ♀, [A. N. S. P.].

St. Jean du Maroni, French Guiana, IV and V, 2 ♂, 1 ♀, 1 small juv.

Charvein, French Guiana, 1 ♀.

Igarapé-Assú, Pará, Brazil, 1, 17 to 11, 6, 1912, (H. S. Parish,) 11 ♂, 13 ♀. *type, allotype and paratypes*, [A. N. S. P.].

***Neoblattella adpersicollis* (Stål)**

1861. *Blatta adpersicollis* (Stål), Kongl. Svenska Freg. Eugenie's Resa, Zool., I, p. 308. [♂; Rio de Janeiro, [Brazil].]

Bahia, Brazil, 1 ♀.

Tijuca, Rio de Janeiro, Brazil, 600 to 900 meters, 1 ♂, 1 ♀, 1 juv.

The specimens from Rio and Bahia show the dark flecks on the face, arranged in nearly transverse lines, as described by Stål; the others have these markings very weak, indicated by fewer and faint suffusions.

The considerable variation in tegminal length is shown by the following measurements (in millimeters).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
La Forestière, French Guiana	---	4.8	6.3	20.5	5.9
Pará, Brazil	15.3	4.6	6.3	18.8	5.4
Rio de Janeiro, Brazil	15.3	4.7	6.1	15.7	5.1
♀					
Trinidad, British West Indies	15.2	4.4	5.9	17.8	5.1
Bahia, Brazil	13	4.4	5.9	16	4.7
Rio de Janeiro, Brazil	16	4.8	6	14.4	5

***Neoblattella eudromielloides* new species. Plate X, figures 2, 3 and 4.**

This handsomelittle insect is closely related to *N. berlandi*, described on page 234, differing in the smaller size, paler head, broader interocular space, pronotum with medio-longitudinal portion nearly immaculate, tegmina with proximal portion of anal sulcus as heavily suffused as costal marginal area toward the discoidal vein and male subgenital plate which, though similar in type of specialization, differs strikingly in the deep concavity of the lateral margins and much smaller cucullate areas protecting the spines which replace the usual cylindrical styles.

These species, with *N. fasciata* (Brunner), from a group which we

designate as the Berlandi Group, distinguished by their comparatively graceful structure and strikingly bicolored tegmina.⁴⁷

The superficial resemblance of this insect to *Eudromiella bicolorata* Hebard is striking; closer examination, however, showing the great differences between these species.

Type: ♂; Passa-Quatro, Rio Las Piedras, Minas Geraes, Brazil. Elevation 1000 meters. [Paris Museum.]

Size small and form slender for the genus. Eyes large, interocular space nearly two-thirds that between the antennal sockets. Ocellar spots not large but distinct, these and the maxillary palpi much as in *berlandi*. Pronotum much as in that species, but showing latero-cephalic as well as weaker latero-caudal shallow depressions. Tegmina and wings fully developed, extending well beyond cereal apices. Tegmina with (6 and 7) longitudinal discoidal sectors. Wings with clubbed apices of costal veins elongate and heavy, ulnar vein with (5) complete branches, intercalated triangle distinct, width one-half length. Dorsal surface of abdomen unspecialized, latero-caudal angles very bluntly rounded. Supra-anal plate transverse, one-third as long as proximal width, feebly obtuse-angulate produced, but with apex moderately bilobate. Subgenital plate nearly symmetrical;⁴⁸ lateral portions briefly produced, with straight margins, then suddenly emarginate for an equal distance, forming a projection which is less than rectangulate sinistral, rectangulate dextral; from these points the plate is again produced and shallowly curled upward, the margins hardly convergent, feebly concave to the broad, transverse apex, the lateral emarginations thus formed being nearly rectangulate and feebly rounded. The lateral portions are thickened and more strongly curled at the latero-caudal angles, thus forming a minute rounded cone, the open base of which is caudad and from within which, springing from its base, on each side, project caudad two minute, strongly curved spines, the apices of which reach the caudal margin. Limb armament, pulvilli, arolia and tarsal claws as given for *berlandi*.

Surface shining. Head clay color, the vertex approaching cinnamon-buff, with a very broad interocular band of bister, ocelli buffy, below are three broken bands of bister on the face; the first two each formed by two transverse suffusions which are connected laterad along the antennal sockets, the third formed by four suffusions arranged in a line which is strongly convex ventrad. Pronotum translucent, tinged with cinnamon-buff laterad, with two broad blackish prouts brown longitudinal bands which are separ-

⁴⁷ From the description of *Phyllodromia minor* Brunner, it appears probable that that species is either a member of the present group, or of the genus *Eudromiella*.

⁴⁸ The dextral emargination is slightly deeper than the sinistral.

ated by a brief distance at the cephalic margin, diverging moderately caudad; median area between these ochraceous-buff with two microscopic flecks of prouts brown caudad. Tegmina translucent, tinged with cinnamon-buff in proximal portions and just beyond discoidal vein in entire costal marginal area, from there to discoidal vein suffused with mummy brown, anal sulcus also broadly suffused with mummy brown, this narrowing and becoming subobsolete distad, discoidal field weakly tinged with dresden brown in all but proximal portion. Wings transparent, moderately heavily tinged with mummy brown; the narrow area of the enlarged portions of the costal veins, which is broader than in *berlandi*, light ochraceous-buff. Dorsal surface of abdomen ochraceous-buff, with a weak mottled suffusion of prouts brown. Cerci light ochraceous-buff, the distal joints flecked with black. Ventral surface and limbs light ochraceous-buff, the abdomen with weak brownish suffusions and an impressed fleck of prouts brown laterad on each of the larger segments. Limbs flecked with prouts brown at the bases of the spines, these flecks heavy on the tibiae.

Length of body 10.7, length of pronotum 2.3, width of pronotum 3, length of tegmen 11, width of tegmen 3.2 mm.

The type is unique.

Neoblattella berlandi new species. Plate X, figures 5, 6 and 7.

This species, like *N. eudromielloides* described on page 232 and *N. fasciata* (Brunner), has the tegmina distinctly bicolored

Nearest relationship is with *eudromielloides*, under which species the two are compared.

Type: ♂; Upper basin of Amazon River, on frontier between Peru and Bolivia.⁴⁹ (From Captain Mailles.) [Paris Museum.]

Size medium small and form slender for the genus. Eyes prominent, interocular space slightly more than half width between antennal sockets, ocellar spots weakly indicated but flattened surfaces of these areas oblique, rounding into the intervening flattened area; lateral margins of face subparallel to clypeal suture. Maxillary palpi very slender and elongate, the fourth joint gradually widening distad, fifth joint three-fifths as long as fourth. Pronotum moderately convex to lateral portions, showing a pair of shallow but distinct latero-caudal depressions, caudal margin very broadly convex, showing a very feeble tendency toward an obtuse-angulation. Tegmina and wings fully developed, extending well beyond cercal apices. Tegmina with (9) longitudinal discoidal sectors. Wings with clubbed distal portions of (13) costal veins elongate and heavy; discoidal vein with (6) complete branches; intercalated triangle distinct, width equal to one-half

⁴⁹ We describe this species here, as it is one of the two new species in the Paris Museum collection from Peru, both of which are indeed representatives of the fauna of the upper Amazon drainage.

its length. Dorsal surface of abdomen unspecialized, latero-caudal angles very bluntly rounded. Supra-anal plate simple, transverse, curled ventrad, about half as long as width between cerci, free margin concave about cerci, broadly convex in portion between these. Subgenital plate symmetrical, lateral margins broadly convex and forming a weakly defined obtuse-angulation beneath cerci, convergent one-quarter the distance between the cerci on each side, there sharply but briefly emarginate and at these points curled inward, forming a short cone, the open base of which is caudad and within which, springing from the extremities of the median section of the caudal margin, project caudad on each side, two minute, slightly curved spines; median section of caudal margin transverse, subchitinous. Ventro-cephalic margin of cephalic femora armed with a row of spines which decrease gradually in size distad, terminating in two elongate spines, of which the more distal is the longer. Limb armament, pulvilli, tarsal claws and arolia as characteristic of the genus. Teeth of flange on tarsal claws well developed, the last tooth half as large as the point of the claw.

Surface shining. Head with vertex blackish brown to ocellar areas, there with a broad transverse band of ochraceous-buff, margined ventrad by a band of blackish brown which is nearly as broad, eyes hazel, antennae and remaining portions of face translucent clay color, the latter with two interrupted bands of blackish brown. Pronotum translucent, tinged with cinnamon-buff laterad, with two broad blackish longitudinal bands which fuse at the cephalic margin and diverge caudad, area between these clay color, with a longitudinal heavily suffused streak and two lateral dots of blackish brown and a dot of cinnamon-buff cephalad. Tegmina translucent, tinged with cinnamon-buff proximad in anal field and beyond to first branch of median vein and also from just beyond discoidal vein in entire costal marginal area, from there to discoidal vein suffused with mummy brown and in entire discoidal field suffused with dresden brown as is the anal sulcus. Wings transparent, rather heavily tinged with mummy brown, the narrow area of the enlarged portion of the costal veins light ochraceous-buff. Dorsal surface of abdomen prouts brown, deepening to mummy brown distad. Cerci dresden brown, tinged with mummy brown proximad. Ventral surface of abdomen dresden brown, maculate with mummy brown. Limbs and spines buckthorn brown, cephalic femora suffused dorsad and along ventro-caudal margin with mummy brown, tibiae with blotches of mummy brown at base of each dorsal spine.

Length of body 11.5, length of pronotum 2.7, width of pronotum 3.3, length of tegmen 12.1, width of tegmen 3.3 mm.

The type is unique.

LIOSILPHA Stål.

1874. *Liosilpha* Stål, Bihang till K. Svensk. Vet.-Akad. Handl., Band 2, No. 13, p. 10.

This genus, erected to include *Blatta pumicata* Stål, *adpersicollis* Stål⁵⁰ and *dilatata* Saussure,⁵¹ was restricted to the first species by Kirby's genotypic designation in 1904⁵² and briefly diagnosed by Shelford in 1911⁵³.

A specimen of the genotype now before us, enables us to place the genus definitely as an aberrant member of the Group Blattellae, its broad form and moderately reduced organs of flight giving a rather close general resemblance to the actually very widely separated Old World genus *Allacta*.⁵⁴

We find *Liosilpha* to be a distinctive genus, showing no close relationships, but best placed on linear arrangement after *Blattella* Caudell. In heaviness of limb armament, convergence toward the normal in the Blattinae is shown, but the ensemble of characters clearly demonstrates the proper assignment to be that indicated above.

The following generic characters are shown by the female before us. Size medium large for the group, form very broad, structure not as delicate as is usual in the group. Interocular space broad (slightly narrower than that between the antennal sockets), ocellar spots ample but weakly defined. Lateral margins of cheeks weakly convergent ventrad. Maxillary palpi moderately elongate, (fourth joint intermediate in length between third and fifth, the latter with greatest width mesad). Pronotum broad, weakly convex, becoming decidedly convex laterad, caudal margin broadly truncate. Tegmina showing some reduction (extending nearly to the cercal apices in the specimen at hand), moderately corneous, except in area of dextral tegmen concealed when at rest, with veins not distinguishable unless held up to the light, anal sulcus finely impressed, delimiting the elongate-pyriform anal field, discoidal sectors (6 to 8) longitudinal.⁵⁵ Wings showing moderate reduction, the venation slightly irregular, (8) costal veins weakly clubbed, median vein (once or twice) forked, ulnar vein with (2⁵⁶) complete branches, intercalated triangle very weakly developed. Supra-anal plate with apex rather deeply V-emarginate. Subgenital plate simple, short. Cephalic femora with ventro-cephalic margin armed with

⁵⁰ Genotype of *Neoblattella*.

⁵¹ Belonging to the genus *Latiblattella*.

⁵² Syn. Cat. Orth., I, p. 96.

⁵³ Ent. Mo. Mag., (2), XXII, p. 156.

⁵⁴ Our statement in 1907, that we did not believe this species to be a member of this group, was due to the fact that, without material for study, the characters as far as described seemed to indicate other association.

⁵⁵ We are at a loss to explain Shelford's characterization of these veins as oblique. He apparently had material of *pumicata* before him, as his comments on the genus agree in all other respects.

⁵⁶ One of these again branches.

a series of decidedly heavy, elongate spines, which gradually decrease in length distad, terminating in spines which are elongate in increasing ratio distad; ventro-caudal margin in distal half with (3 and 1 distal) heavy, elongate spines. Other femora with ventral margins armed with numerous heavy, elongate spines, and with very elongate genicular spines. Four proximal tarsal joints supplied with large pulvilli. Large arolia present between the simple, very weakly asymmetrical tarsal claws,

Liosilpha pumicata (Stål) Plate X, figures 9 and 10.

1860. *Blatta pumicata* Stål, Kongl. Svenska Freg. Eugenie's Resa, Zool., I, p. 309. [♂; Rio de Janeiro, [Brazil].]

Tijuca, Rio de Janeiro, Brazil, 1 ♀, [Hebard Cln.].

This specimen has the dorsal surface shining, clay color, except for the lateral portions of the pronotum and marginal fields of the tegmina, which are transparent, tinged with cinnamon-buff. The dorsal surface of the abdomen is suffused with bister laterad and distad, leaving the lateral margins of the wider tergites cinnamon-buff. The cerci and limbs are cinnamon-buff, the latter with very small flecks of brown at the spine bases. The ventral surface of the abdomen is more narrowly suffused with bister laterad, with a large pale marginal spot on each sternite, the subgenital plate bister proximo-laterad and opposite the cerci, these latter suffusions extending mesad and connecting, but very weak in median portion.

Length of body 12, length of pronotum 4.3, width of pronotum 5.7, length of tegmen 10.8, width of tegmen 4, length of caudal femur 5.2 mm.

LITOBLATTA new genus.

This genus is erected to include the single species, "*Ischnoptera*" *brasiliensis* of Brunner.

The males differ from those of *Ischnoptera* in being of a more delicate structure, wings with area between discoidal vein and anterior margin broader, unspecialized dorsal surface of abdomen, transverse supra-anal plate and cephalic femora with spines not distinctly biseriate.

Females differ in having lobiform, lateral tegmina, sixth tergite bluntly triangularly produced over the similarly produced supra-anal plate and almost completely concealing the latter and cephalic femora with spines even less appreciably biseriate than in males.

The production caudad of a tergite, which almost entirely conceals the supra-anal plate in the female sex, is a feature unknown to us for any other species of the American Pseudomopinae.

In linear arrangement we place this genus before *Symploce* Hebard,

as the first of the known genera of the Ischnopterae having the cephalic femoral spine armament of the uniseriate type.

Generic Description. Structure of males very delicate, of females strongly chitinous. Head elongate, ocelli distinct; flat surfaces of ocellar areas forming a rather sharp angle with the interocellar space in males, this area much reduced and less distinctly defined in females. Pronotum of male moderately convex, with oblique sulci present and caudal margin very weakly and broadly convex; of female more decidedly and evenly convex, with caudal margin truncate and showing scarcely any convexity. Tegmina of male fully developed, with discoidal sectors weakly radiating; of female represented by coriaceous lateral pads. Wings of male with area between discoidal vein and anterior margin moderately broad; mediastine vein extending more than half the distance to apex of wing, from which spring a number of the costal veins, none of the costal veins enlarged distad; discoidal vein branching, the forks dividing toward apex of wing; ulnar vein almost straight, with incomplete and complete branches; intercalated triangle small and inconspicuous. Wings absent in female. Dorsal surface of male abdomen unspecialized. Supra-anal plate of male transverse. Female with sixth tergite (Pl. X, fig. 17A) bluntly triangularly produced over the similarly produced supra-anal plate (Pl. X, fig. 17B) and almost completely concealing the latter. Cephalic femora with ventro-cephalic margin armed with heavy elongate spines, which decrease strongly but irregularly in size distad,⁵⁷ terminating in three heavy and elongate spines, elongate in increasing ratio distad. Very small distal pulvilli present on four proximal tarsal joints in males, absent in females. Small arolia present between the elongate, slender, simple, symmetrical tarsal claws.

Litoblatta brasiliensis (Brunner) Plate X, figures 14, 15, 16 and 17.

1865. *I[schnoptera] brasiliensis* Brunner, Nouv. Syst. Blatt., p. 130, pl. III, fig. 12. [♂, Brazil.]

1897. *L[oboptera] laurenziana* Giglio-Tos, Bull. Mus. Zool. Anat. comp. Univ. Torino, XII, No. 302, p. 2. [♀; San Lorenzo, Jujuy and Tala. Salta, Argentina.]

Passa-Quatro, Rio Las Pedras, Minas Geraes, Brazil, 1000 meters, I ♂.

The description shows that Giglio-Tos failed to associate the sexes of *brasiliensis*, erecting the synonymous *Loboptera laurenziana*, based on the female sex of the species.

⁵⁷ In males of *brasiliensis* this series may be called uniseriate only because the transition from the heavy elongate proximal spines to the small, but not piliform, distal spines is irregular and not abrupt. In some males a number of the more distal spines, being smallest and of subequal size, might lead one to term the spine armament of this margin biseriate.

In the females the decrease averages less but shows similar individual variability.

The large Argentinian series before us is recorded on page 264 and a table of measurements for the species is supplied on page 265 of the present paper.

NYCTIBORINAE.

Nyctibora sericea Burmeister.

1826. *Blatta limbata* Thunberg, (not of Charpentier, 1825), Mém. Acad. Imp. Sci. St. Pétersb., X., p. 278.

1838. *Nyctibora sericea* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 501. [Brazil.]

Tijuca, Rio de Janeiro, Brazil, 1 juv. ♂, 1 juv. ♀.

Shelford has pointed out that Burmeister's *sericea* was the same as Thunberg's *limbata*, but failed to note that the latter author's *Blatta limbata* was preoccupied.

EPILAMPRINAE.

Phoraspis flavipes Blanchard.

1837. *Phoraspis flavipes* Blanchard, Ann. Soc. Ent. France, VI, p. 291, pl. XI, fig. 2. [Brazil.]

Tijuca, Rio de Janeiro, Brazil, 500 to 1000 meters, VIII to X, 1 ♀, [Hebard Cln.].

*Phoraspis brachytaenia*⁵⁸ new species. Plate XV, figure 3.

This insect is very closely related to *P. picta* (Drury) and may prove to be a geographic race of that species. It may, however, be quickly recognized by its slightly more slender appearance and shorter tegminal bands.

Type: ♂; State of Santa Catharina, Brazil. [Hebard Collection, Type no. 753.]

Size smaller and form slightly more slender than in *picta*. In other respects agreeing closely with that insect, except that the vinaceous-rufous lateral band on each of the tegmina is, both dorsal and ventrad, much shorter, being abruptly terminated distinctly before the median portion of the tegmen, while in *picta* it extends considerably caudad of that point and narrows more gradually to its apex.

Allotype: ♀; Morretes, Paraná, Brazil. [Paris Museum.]

Agrees closely with the male sex, except in its somewhat larger size. In form the sexes are similar, the present female being slightly more slender than the males of *picta* at hand.

General coloration shining black. Interocular space broadly ochraceous-tawny, marbled with buff which shows a tinge of orange. First three joints of antennae blackish brown, varying to ochraceous-

⁵⁸ From βραχυ-ταυνία, in allusion to the reduced band of the tegmina, which is much shorter than in the very closely allied *P. picta*.

tawny. Pronotum with lateral portions of cephalic margin rather narrowly translucent warm buff, the internal margins of those areas as broadly convex as the external margins. Tegmina dorsad and ventrad with a broad proximal band of vinaceous-rufous, terminating abruptly before the median portion, this band of about equal width throughout, covering the space from the humeral trunk to near the costal margin proximad, the mediastine vein running obliquely through its distal portion.⁵⁹

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen	Length of taenia	Width of taenia
<i>P. picta</i>							
Tijuca, Rio de Janeiro, Brazil	15.2	5	7.3	14.8	7.3	8.5	1.8
Tijuca, Rio de Janeiro, Brazil	16.3	5.5	8	15	7.4	9.5	1.9
<i>P. brachytaenia</i>							
Santa Catharina, Brazil, <i>type</i>	15	4.8	6.6	13	6.6	5.7	1.7
Morretes, Paraná, Brazil, <i>paratype</i>	13.7	4.9	6.3	12.8	6	4.9	1.1
Morretes, Paraná, Brazil, <i>paratype</i>	14.2	4.8	6.7	13	6	6.2	1.7
Morretes, Paraná, Brazil, <i>paratype</i>	14	4.6	6.7	13	6	6.3	1.7
♀ Morretes, Paraná, Brazil, <i>allotype</i>	16.	5.8	7.2	14	7	5.9	2

In addition to the type and allotype, three paratypic males, bearing the same data as the allotype, have been examined.

Phoraspis picta (Drury) Plate XV, figure 4.

1782. [*Blatta*] *picta* Drury, Ill. Exot. Ent., III, p. 76, ind. (2), pl. 50, fig. 3.
[Rio de Janeiro, Brazil.]

Tijuca, Rio de Janeiro, Brazil, 800 to 1000 meters, 2♂.

These specimens are discussed, measured and compared under the treatment of the preceding closely related insect.

Epilampra verticalis Burmeister.

1838. *E[pilampra] verticalis* Burmeister, Handb. Ent., II, Abth. II, Pt. I,
p. 505. [Brazil.]

Passa-Quatro, Rio Las Pedras, Minas Geraes, Brazil, 1000 meters,
2 ♀.

Hedaia yersiniana (Saussure) Plate XII, figures 3 and 4.

1864. *Epilampra yersiniana* Saussure, Rev. et Mag. de Zool., (2), XVI, p.
324. [♀, Brazil.]

Curityba, Paraná, Brazil, 1♂, [Hebard Cln.].

⁵⁹ Though weakly indicated, this is the only vein distinctly discernible on the heavily and very thickly impresso-punctate tegminal surface.

This is the first specimen of this magnificent cockroach, largest of the known American *Epilamprinae*, we have seen.

Length of body 38, length of pronotum 8.3, width of pronotum 12.7, length of tegmen 51.2, width of tegmen 15 mm.

The limb armament, tarsi, pulvilli and tarsal claws are similar to those of the species of *Epilampra* here recorded, except that the large spines are so large that their margins can be seen to be strongly, though microscopically, serrulate, while the three tarsal joints after the metatarsus all have minute spines bordering the large pulvilli laterad, these briefly continued proximad in the proximal section of the second joint, the ventral surface of which is not fully occupied by the pulvillus.

The form of the pronotum, strongly convex above the head and flat in the produced meso-caudal portion, is very different from that of any of the species assigned to *Epilampra*, while the apices of the tegmina are on the median line and rather sharply rounded.

BLATTINAE.

Periplaneta americana (Linnaeus)

1758. [*Blatta*] *americana* Linnaeus, Syst. Nat., Ed. X, p. 424. [America.]

Bahia, Brazil, 1 ♂.

Rio de Janeiro, Brazil, 3 ♂, 1 juv.

PANCHLORINAE.

Leucophaea maderae (Fabricius)

1781. *B[lat]ta maderae* Fabricius, Spec. Ins., I, p. 341. [Madeira.]

Bahia, Brazil, 2 ♂, 1 small juv.

Pycnoscelus surinamensis (Linnaeus)

1767. [*Blatta*] *surinamensis* Linnaeus, Syst. Nat., Ed. XII, p. 687. [Surinam.]

Bahia, Brazil, 1 ♀, 1 juv.

Rio de Janeiro, Brazil, 1 ♀.

Tijuca, Rio de Janeiro, Brazil, 800 to 900 meters, 1 ♀.

Panchlora cubensis Saussure.

1862. *P[anchlora] cubensis* Saussure, Rev. et Mag. de Zool., (2), XIV, p. 230. [♀, Cuba.]

Bahia, Brazil, 5 ♂, 3 ♀.

Panchlora prasina Burmeister.

1838. *P[anchlora] prasina* Burmeister, Handb. Ent., II, Abth. II, Pt. I. p. 507. [Rio [de Janeiro], Brazil.]

Tijuca, Rio de Janeiro, Brazil, 500 to 900 meters, 1 ♀.

We agree with Brunner in considering Saussure's *P. glauca*, described from Brazil, a synonym of this species.

Of the green and plainly colored species of this genus, *prasina* attains the largest size, apparently usually exceeding even the largest individuals of *P. exoleta* Burmeister. The measurements for the present specimen are: length of body 25, interocular width .7, length of pronotum 7.7, width of pronotum 9.5, length of tegmen 27.2, width of tegmen 9.2 mm.

Tribonium conspersum (Guérin and Percheron) Plate XII, figure 7.

1835. *B[latta] conspersa* Guérin and Percheron, Gen. Ins., 2e Livr., No. 3, pl. 2. [Brazil.]

Tijuca, Rio de Janeiro, Brazil, 1 ♀, 7 juv. ♂, 3 juv. ♀.

This species has been synonymized under *T. spectrum* (Eschscholtz). We find that the tegmina and wings scarcely surpass the apex of the abdomen in the female here recorded, as so splendidly figured by Guérin and Percheron, and described by Serville.⁶⁰ In addition, the reflexed proximal portion of the tegminal marginal field is distinctly lower than wide, with a weak emargination of the costal margin at its base. As a result, the name *conspersum* is restored. This condition may be found to represent a geographic race of *spectrum*, but at present insufficient material is at hand to determine whether or not that is true.

The measurements of the present female are; length of body 22.1, length of pronotum 4.9, width of pronotum 9.1, length of tegmen 20, width of tegmen 7.6 mm.

Four instars of the handsome and very differently marked immature condition (shown by the figure here given) are represented.

Tribonidium signaticollis (Burmeister) Plate XII, figure 8.

1838. *Z[etobora] signaticollis* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 510. [Brazil.]

Curityba, Paraná, Brazil, 1 ♂, [Hebard Cln.].

At first glance, this specimen would appear to be solidly blackish chestnut-brown in general coloration, except for the transparent portion of the pronotum cephalad, which is tinged with warm buff. On closer examination, however, the pronotum is seen to have patches of very slightly paler color mesad and latero-caudad, showing a rich deep mahogany red tinge, the marginal and anal fields of the tegmina very faintly tinged with this color.

⁶⁰ Recorded by that author and later by Guérin, from Cuba, almost certainly in error. The material recorded as this species by Burmeister, Saussure and Brunner represents instead the closely related *spectrum*.

The present specimen is apparently somewhat larger than the individual originally described; length of body 17, length of pronotum 4.6, width of pronotum 6.7, length of tegmen 16, width of tegmen 5.6 mm.

The genus *Tribonidium* includes species with pronotum impresso-punctate and cephalic margin convex, as in *Zetobora*. The pronotum is, however, not broadly though conspicuously reflexed toward the cephalic margin, agreeing in this respect with *Phortioeca* instead. The species are of small size compared with those of the allied genera and in the present species the pronotal magnitude is comparatively very small.

Tribonidium amplum new species. Plate XII, figures 9 and 10.

This insect is evidently closely related to *T. transversum* (Brunner),⁶¹ differing in the larger size, more ample pronotum and tegmina and, wings, which in the male sex, show no reduction whatever.

Compared with the male of *T. signaticollis* (Burmeister) recorded above, the present males are seen to differ in the conspicuously broader pronotum, with impressed punctae smaller and nearly absent in the cucullate portion, scattered and minute caudad of that area, entire cucullate and discal portions of pronotum appreciably flattened and more ample organs of flight.

Type: ♂; Tijuca, Rio de Janeiro, Brazil. [Paris Museum.]

Size large, form moderately broad, for this genus of small and moderately broad, though graceful, species. Head flat, interocular space broad, slightly over half as broad as that between the antennal sockets, interocular area shallowly concave; ocelli large, their surfaces at a decidedly obtuse angle to the interocellar area. Maxillary palpi very short, third joint subequal in length to the enlarged fifth joint, fourth joint three-fifths as long, expanding strongly distad. Pronotum ample; cephalic margin broadly convex to the rounded lateral angles, weakly reflexed in lateral portions; lateral angles situated slightly caudad of median point, latero-caudal margins to shoulders of equal obliquity and convexity to lateral portions of cephalic margin, caudal margin between humeral shoulders transverse, with median angulation feebly suggested. Pronotum cucullate above head, this and the area caudad to the shoulders raised

⁶¹ It appears doubtful from the literature that Saussure's assignment of *transversum* under his *monasticum* is correct. From his description and figure of the latter species it would appear to differ from *transversum* in having a pale transverse band on the vertex, the pronotum more ample (5.5 by 8.5 mm.), with caudal margin more strongly transverse, but with tegminal and wing length apparently proportionate. Unfortunately Saussure did not give separate measurements for the sexes. A smaller Brazilian female recorded by that author, having the head dark and immaculate is apparently referable to *transversum*.

and flattened, with a few small, weak depressions and minute widely scattered impressed punctae in caudal portion, which portion laterad is bounded by low rounded ridges, strongly divergent from base of hooded portion, then parallel to the shoulders; surface latero-caudad thickly impresso-punctate, though not as heavily or thickly as in *signaticollis*. Tegmina and wings fully developed, showing no reduction whatever and extending well beyond apex of abdomen. Abdomen, including asymmetrical Panchloroid subgenital plate, with straight, elongate, similar styles; limbs short; cephalic femora supplied with a few minute chaetiform spines distad, terminating in a single stout though greatly reduced spine; other femora unarmed, lacking even genicular spines; large pulvilli and large arolia between the simple, symmetrical tarsal claws, all as characteristic of the genus.

Allotype: ♀; State of Minas Geraes, Brazil. [Paris Museum.]

Agrees with the type, except as follows. Size larger, form somewhat broader, tegmina and wings showing some reduction, reaching to base of supra-anal plate. Head broader and more flattened, interocular space three-fifths that between antennal sockets, ocelli smaller. Pronotum broader, the lateral angles slightly more caudad in position, the cucullate and other raised portions minutely and rather thickly impresso-punctate, though by no means as thickly as in the male of *signaticollis* before us. Subgenital plate large, simple, free margin broadly concave opposite cerci.

General coloration (of males) deep chestnut-brown; the translucent latero-caudal portions of the pronotum and tegmina, when held to the light, chestnut brown. Pronotum with cephalic third dully transparent warm buff, the darker color invading this area in cucullate portion to near the cephalic margin, the caudal borders on each side straight, transverse, considerably cephalad of the lateral angles. Ventral surface cinnamon-buff, the abdominal segments with lateral areas and femora distad paler, buckthorn brown. Antennae blackish brown, becoming chestnut brown proximad.

The female is similar but darker, more solidly blackish brown, with cephalic third of pronotum dully transparent antimony yellow.

Length of body ♂ 18.3⁶²–18.8, ♀ 20.7; length of pronotum ♂ 4.9–5, ♀ 5.3; width of pronotum ♂ 7.–7.8, ♀ 8.2; length of tegmen ♂ 17.3–17.7, ♀ 15.2; width of tegmen ♂ 6–6.2, ♀ 6.1 mm.

In addition to the described pair, a paratypic male and five immature examples, bearing the same data, are at hand.

The immature condition is strongly patelliform, the dorsal surface minutely and thickly tuberculate, these interspersed with more prominent tubercles.

General coloration verona brown, beautifully and symmetrically marked with cinnamon-buff. Transparent portion of pronotum cephalad ochraceous-buff, other segments streaked laterad and punct-

⁶² The measurements of the type are given first.

ate at caudal margins with cinnamon-buff, a medi-longitudinal band of this color on mesonotum and metanotum, the abdomen with broadly projecting portions of tergites paler, tessellate, and with a concentric paler tessellate area, this inclosing the median portion of the median segment and first two tergites, which area is of the darker ground color, the tergites each with a fleck cinnamon-buff between the lateral and median areas.

Without much larger series than have ever been assembled, the separation of many of the species of such genera as the present, *Phoraspis*, *Paratropes* and *Tribonium*, is a most difficult problem. The differences shown by the forms recognized by us as *Tribonidium monasticum*, *transversum* and *amplum*, may indicate full specific distinction, geographic racial differentiation or, indeed, mere individual variation in a single exceptionally plastic species. Additional material with full data would throw much light on this problem, if not definitely solving it. Color differences such as are shown and different degrees of structural and tegminal and wing modification are sometimes unimportant, sometimes of great diagnostic value. It is clear that in genera such as the present, where limb armament is so greatly reduced and the genitalic features may show generic but not specific differences, we are forced to weigh the recognizable differences and to form conclusions as to their value in each individual case, without the degree of assurance possible when familiar with other groups and working with even unique individuals of many of the species.

BLABERINAE.

Petasodes mouffeti (Kirby) Plate XIII, figure 4.

1817. *B[latta] mouffeti* Kirby in Spence, *Introd. Ent.*, II, p. 329. [Brazil.]

1818. *B[latta] mouffeti* Kirby, *Trans. Linn. Soc.*, XII, p. 448. [Brazil.]

Tijuca, Rio de Janeiro, Brazil, 1 ♀, 2 juv. ♀.

Kirby first proposed this name for a species he recognized as having large pulvilli and no arolia between the tarsal claws, referring to Mouffet's figure published in 1634. That figure is extremely unsatisfactory, though we do not agree with Burmeister in considering it to resemble more closely *Leucophaea maderae* (Fabricius) than the species now assigned to the genus *Petasodes*. In 1818, Kirby has given a description of the insect, decidedly more comprehensive than many of that time, and we follow Burmeister, but not subsequent authors, in recognizing *mouffeti* as a distinct species.

Compared with females of the other species of the genus before us, the present female is seen to be decidedly narrower, with pron-

tal margin, both cephalad and caudad, pale, the tegmina elongate and the wings fully developed.

Length of body 36, length of pronotum 11, width of pronotum 19.8, length of tegmen 35, width of tegmen 15.8 mm.

The immature condition of this species is extraordinarily handsome. Though moderately supplied with microscopic spines on the dorsal surface (particularly on the thoracic segments, very sparingly on the median segment and proximal abdominal tergites) those before us have few particles of foreign matter adhering and appear smooth and shining to the naked eye. The general coloration is warm buff, the lamellate margins weakly transparent and light buff, the insect beautifully marked with rich blackish brown, shading to prouts brown as shown by the figure. Adults and immatures may be readily separated from those of *Monastria biguttata* (Thunberg) by the femoral spination. In the present species the cephalic femora have on their ventro-cephalic margin a minute but heavy distal spine, preceded by a few irregularly placed chaetiform spinulae; the median and caudal femora bear only a minute but heavy genicular spine.

***Monastria biguttata* (Thunberg)**

1826. *Blatta biguttata* Thunberg, Mém. Acad. Imp. Sci. St. Pétersb., X, p. 276, pl. 14. [♀, Brazil.]

Tijuca, Rio de Janeiro, Brazil, I ♂, 4 juv.

Adults and immatures may be quickly separated from those of *Petasodes mouffeti* (Kirby) by the femora, which entirely lack heavy spines, the cephalic femora being supplied distad on the ventro-cephalic margin with minute chaetiform spines and dorsad along the caudal portion of the distal margin with a few similar spinulae.

All of the juveniles are heavily coated with foreign particles, which gives them a dingy unattractive appearance. These particles are seen under the microscope to be adhering to a multitude of closely placed, minute and usually curved spines, which cover the dorsal surface and marginal portions of the ventral surface. A color pattern, somewhat resembling that of juveniles of *P. mouffeti*, is barely discernible on the dorsal surface of the abdomen through its dingy coating.

CORYDIINAE.

CEUTHOBIELLA new genus.

1920. *Melestora* Hebard (not of Stål), Mem. Am. Ent. Soc., No. 4, p. 121.

To this genus belong the species described as *Melestora minutissima* by Rehn, from Igarapé-Assú, Pará, Brazil, and as *Melestora micra* by Hebard from Paraiso, Canal Zone, Panama.

Genotype.—*Ceuthobiella minutissima* (Rehn).

The genus is closely related to *Ceuthobia*, described on page 292, males agreeing in the comparatively slender form, interocular space not wrinkled, pronotum broadest meso-caudad with latero-caudal oblique sulci moderately well defined but no trace of medio-longitudinal sulcation, sinistral tegmen without a diagonal channel, wings with radiate field folding fan-wise and dorsal surface of abdomen with median segment specialized.

It differs in the even smaller size,⁶³ darker general coloration, minute and inconspicuous ocelli, tegmina with discoidal sectors almost longitudinal,⁶⁴ much narrower wings which are only slightly over half as broad as long, scarcely appreciable costal veins which are not clubbed distad, subobsolete intercalated triangle, subgenital plate more asymmetrical and showing a different type of specialization and complete absence of genicular or other spines on the femora.⁶⁵

It would appear probable that *Nothoblatta* Bolivar (Mitth. Schweiz. Ent. Ges., XI, p. 139, (1905).), including the single species, *wasmanni* Bolivar, belongs to the present group of genera and is nearest to *Ceuthobiella*. From the literature, that genus apparently differs in cephalic, palpal, pronotal, genitalic and tibial features. Unfortunately the description is vague concerning some of the most important characters.

Oulopteryx meliponarum new species. Plate XY, figures 7, 8, 9 and 10.

This striking species is first Blattid known to inhabit the nests of bees. The series from which it is described was taken from the nest of the diminutive, black, stingless bee, *Melipona nigra* Lepeletier.

Compared with *O. dascilloides*, described on page 215, the present insect is seen to differ in the much paler brown coloration, somewhat less coriaceous and much more hairy pronotum and teg-

⁶³ The two described species are the smallest of the fully winged American Blattidae known. Length of body, in normal position, approximately 4.5 mm.

⁶⁴ Only the last of these toward the sutural margin is seen to be weakly oblique to that margin.

⁶⁵ The ventro-cephalic margins of the cephalic femora are supplied in distal portion with a row of hairs, approaching the condition we term piliiform spines. (from type of *A. minutissima*).

mina, more ample and distinctly more flattened pronotum, tegmina with costal margin less decidedly oblique in distal portion, features of the genitalia and somewhat less decidedly atrophied armament of the cephalic femora.

The annulate antennae afford a striking feature of coloration.

Type: ♂; Fazenda do Sobrado, near Passo-Quatro, Minas Geraes, Brazil. June. [Paris Museum.]

In addition to the characters given in the generic description on page 214, we record the following. Eyes extending briefly ventrad of antennal sockets, convergent lateral margins of cheeks to clypeal suture brief. Interocular space slightly over half width between antennal sockets. Maxillary palpi with fifth joint large, slightly shorter than third, fourth joint two-thirds as long as third joint. Pronotum with bosses of disk smooth, showing a somewhat lyrate pattern; other portions, including weak bosses at humeral shoulders, heavily impresso-punctate. Tegmina moderately coriaceous, extending distinctly beyond cercal apices, margins converging evenly distad. Wings with rolls of folded appendicular fields lying obliquely. Median segment as described for *dascilloides*. Supra-anal plate with length equal to about one-fourth proximal width, suddenly and strongly concave in meso-distal portion, lateral margins convergent and forming rather broadly convex projections on each side of this area, moderately supplied with long hairs in these portions, median section of margin nearly transverse, showing a very feeble convexity, without hairs. The ventral surface of this plate is symmetrically specialized, mesad on each side at the base of the projecting portions it is produced in a transverse and chitinous triangular projection, with apex acute and curved outward toward each side, these fang-like processes lie on the deeply concave faces of two large subchitinous, symmetrical plates, which, springing from near the cercal bases, are transverse and vertical, reaching to the anal opening. Subgenital plate small and nearly symmetrical, lateral margins equally oblique, the sinistral very feebly convex, the dextral as feebly concave, rounding into the transverse distal margin at the style sockets. Styles similar, simple, straight, cylindrical, not tapering except at the rounded apex, each about six times as long as its width, three-quarters as long as the distance between the style bases. Cephalic femora with ventro-cephalic margin supplied distad with minute, piliform, well separated spines, terminated by a single elongate, heavy distal spine.

Allotype: ♀; same data as type. [Paris Museum.]

Agrees closely with the male sex, differing in the following features. Interocular space wider, nearly as wide as that between the antennal sockets. Tegmina and wings showing some slight reduction, extending to cercal apices. Dorsal surface of abdomen unspecialized. Supra-anal plate slightly over two-fifths as long as proximal width lateral margins nearly straight, oblique to the

rather broadly truncate apical portion, the surface of which is weakly concave. Subgenital plate broad, the meso-distal portion (approximately one-sixth of the entire surface) moderately produced, occupied by two rounded-triangular plates, forming nearly vertical valves and separated proximad from the basal portion of the plate by a strongly concave margin.

Coloration of sexes similar. Head bright ochraceous-tawny, becoming ochraceous-orange on occiput, which portion is marked with suffused vertical stripes of rich chestnut brown. Proximal antennal joints, mouthparts and all but distal joint of maxillary palpi ochraceous-buff, last joint of maxillary palpi cinnamon-brown. Antennae in remaining portions mummy brown, near distal extremity with an annulus of light buff (occupying usually three, rarely as many as five, joints). Pronotum shining russet. Tegmina translucent, shining mars brown, paling slightly laterad and distad to russet; portion of dextral tegmen, concealed when at rest, transparent, weakly tinged with tawny. Wings delicate, transparent, very faintly tinged with ochraceous-buff, this more decided in area of costal veins and in radiate field toward its juncture with the appendicular field. Dorsal surface of mesonotum, metanotum and abdomen light ochraceous-buff, the latter in all but proximal portion with a broad marginal suffusion of prouts brown, which broadens distad to include the supra-anal plate and preceding tergites. Cerci cinnamon brown. Ventral surface ochraceous-tawny, often pale and tinged with orange, suffused laterad with prouts brown, this not as broad as dorsad. Limbs ochraceous-buff tinged with tawny.

In the immature condition the shining dorsal surface is tawny or russet, deepening to mars brown laterad. The striking antennal and other markings are as in the adults.

MEASUREMENTS (*in millimeters*).

	♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
<i>Type</i>		10	2.8	3.6	10.6	3.5
<i>Paratypes</i> (5)		9.8-10.8	2.8-2.8	3.4-3.6	10.8-11.1	3.4-3.8
	♀					
<i>Allotype</i>		9.2	3	3.8	9.2	3
<i>Paratypes</i> (3)		9.2-9.4	2.9-3	3.7-3.8	8.6-8.8	3-3

In addition to the type and allotype, a series of five males, three females, three immature males, five immature females and three very small immature specimens are before us, bearing the same data. Of these the adults are designed paratypes. Five different instars of immaturity are apparently represented.

In the paratypes with wings spread, the following measurements are shown: length of wing ♂ 11.7, ♀ 9; width of wing ♂ 8.2, ♀ 6.8;

length of appendicular field ♂ 3.8, ♀ 3.05; width of appendicular field ♂ 4.7, ♀ 3.4 mm.

MELESTORA Stål.

1858. *Melestora* Stål, Kongl. Svenska Freg. Eugenie's Resa, Zool., I, p. 311.

We regret to state that, from the material now available, we are convinced that our recent characterization of the genus⁶⁶ is incorrect, applying instead to the genus *Ceuthobia*, described on page 292.

The genus *Melestora* as here defined, includes the South American species *adpersipennis* Stål, *fuscella* Stål and *argentina* (Rehn).⁶⁷

Genotype.—*Melestora adpersipennis* Stål.⁶⁸

This genus shows, in the male sex, nearest relationship to *Compsodes*, agreeing in the elliptical pronotum with a medio-longitudinal sulcus⁶⁹ and somewhat impressed disk, femora not strikingly enlarged, sinistral as well as dextral tegmen with a conspicuous diagonal channel⁷⁰ and discoidal sectors oblique, wings with anterior field over twice the area of the radiate field, with ulnar vein developing complete arcuate branches and radiate field proximal in position and not folding, dorsal surface of abdomen with third tergite specialized mesad⁷¹ and pulvilli absent.

We find that *Melestora* as properly restricted,⁷² differs from *Compsodes* in the male sex in having the interocular area decidedly wrinkled, the median and caudal femora supplied on their ventrocephalic margins with a single distal spine, as well as having the genicular spine, which is present in both genera.

These genera represent a distinctive group, particularly striking in having the anterior field of the wings very large, in area approxi-

⁶⁶ Mem. Am. Ent. Soc., No. 4, p. 121, (1920).

⁶⁷ Incorrectly referred by us to the genus *Compsodes*, at the time that genus was described. Mem. Am. Ent. Soc., No. 2, p. 209, (1917).

⁶⁸ Selected by Kirby, Syn. Cat. Orth., I, p. 167, (1904).

⁶⁹ In the aberrant *Compsodes cucullatus* (Saussure and Zehntner), the pronotum is produced over the head, the cephalic margin showing greater angulation, while the medio-longitudinal sulcus is subobsolete.

⁷⁰ This channel is not shown by Stål's figure. That author's description of the interocular area and pronotum leads us to the present conclusion and the belief that the diagonal channel was by accident omitted from the figure.

⁷¹ This was not noted by us in our description of *Compsodes schwarzi* (Caudell), Mem. Am. Ent. Soc., No. 2, p. 211, (1917). In that species the third tergite is weakly impressed meso-proximad, with a minute node mesad, surrounded by very minutely microscopic hairs, the caudal margin of the preceding tergite weakly raised, thus showing a broad convexity above this.

⁷² Judging from the data given by Stål, material of *argentina* at hand and a series representing all of the known species of *Compsodes*.

mating that of the tegmen, and radiate field very small and not folding.

Though very close, we believe that *Melestora* and *Compsodes* represent distinct generic units, occupying the same position in the biota of the regions where they are found, the former in the southern portion of tropical South America, the latter in tropical North America.

Euthyrrhapha pacifica (Coquebert)

1804. *Blatta pacifica* Coquebert, Illustr. iconogr. Insect., III, p. 91, pl. XXI, fig. I. [Islands of the Pacific Ocean.]

Rio de Janeiro, Brazil, 1 ♂.

This species was apparently introduced into Brazil, probably from Oceania, a very long time ago; it was recorded from Brazil at an early date and definitely from Rio de Janeiro by Gerstaecker in Van der Decken.⁷³

Hypercompsa cynipoides Walker.

1868. *Hypercompsa cynipoides* Walker, Cat. Blatt. Br. Mus., p. 62. [♂; Tijuca, [Rio de Janeiro], Brazil.]

Curitiba, Paraná, Brazil, 2 ♂.

The present material is assignable without question to Walker's *cynipoides*, which name has been placed in synonymy under *H. fieberi* (Brunner) by Kirby. We do not believe Kirby's action to be correct, but examination of the type of *fieberi* alone can verify this. It would seem probable that Brunner would have described the large and strikingly pale spot of warm buff, on each side of the abdomen latero-proximad, had his material shown this feature. This marking is, as described by Walker, conspicuous, occupying the lateral portions of the first and second tergites and corresponding area ventrad, and shows through the fenestrate tegmina when these are at rest.

Holocompsa nitidula (Fabricius)

1781. *B[latta] nitidula* Fabricius, Spec. Ins., I, p. 345. [[♀], Surinam.]

Bahia, Brazil, 1 ♀.

OXYHALOINAE.

Chorisoneura perlucida (Walker)

1868. *Blatta perlucida* Walker, Cat. Blatt. Br. Mus., p. 99. [♀; Tijuca, [Rio de Janeiro, Brazil].]

Tijuca, Rio de Janeiro, Brazil, May, 2 ♂.

The sinistral style in males of this species has its base produced dextrad and somewhat swollen, bearing a small tuft of agglutinated,

⁷³ Reisen in Ost-Afrika, III, Abth., II, p. 9, (1873).

spiniform hairs. The dextral style bears mesad on its external face a stout chitinous spine, directed proximo-dextrad and curved proximad. The intervening triangular production between the bases of the styles has a minute but stout spine at its apex, another much smaller spine on the dextral margin, the sinistral margin being broadly subchitinous.

The general structure and very faintly tessellate tegmina indicate the close affinity of this species to those of the genus recorded below.

Chorisoneura gracilis (Saussure)

1862. *Bl[atta] gracilis* Saussure, Rev. et Mag. de Zool., (2), XIV, p. 167. [[♀], Brazil.]

Tijuca, Rio de Janeiro, Brazil, 3 ♂, 1 ♀.

The males have the styles longer than in *C. perlucida* (Walker), the dextro-proximal specialization of the sinistral style and intervening triangular production between the bases of the styles in every way similar, the dextral style with a much smaller, minute, spine mesad on its dorsal margin, directed proximad.

Saussure's original description would appear to have been taken from a smaller individual, the material before us agreeing better with Brunner's characterization of his Brazilian *flavoantennata* and with Saussure and Zehntner's discussion of material from Rio Grande do Sul, Brazil, at the time those authors placed *flavoantennata* in the present synonymy.

The tegminal tessellation in these specimens agrees closely with that of *C. perlucida* (Walker). It is, however, a trifle more distinct, while in two individuals the veins proximad are weakly whitish.

Chorisoneura nigrifrons (Serville)

1839. *Blatta nigrifrons* Serville, Hist. Nat. Ins., Orth., p. 109. [♂, ♀; Brazil.]

Tijuca, Rio de Janeiro, Brazil, 1 ♂, [Hebard Cln.].

Closely agreeing with the two previous species in size, form and general coloration, the striking cephalic marking would appear to be a feature by which this species may be readily recognized. The genitalia of the present specimen are in a poor state of preservation.

PERISPHAERINAE.

Brachycola tuberculata (Dalman)

1823. *Blatta tuberculata* Dalman, Analecta Ent., p. 87. [Brazil.]

Tijuca, Rio de Janeiro, Brazil, 3 ♀, 2 small juv.

The very early stage, represented by the immature individuals

before us (length 7 mm.), is generally buffy, the antennae dark with annuli as in the adult, the pronotum with a homologous dark paired patch which, however, sends a ray of the same color latero-caudad instead of cephalad on each side, the mesonotum and metanotum dark in broad meso-proximal portion. In this stage arolia are absent.

HORMETICA Burmeister.

1838. *Hormetica* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 511.

1865. *Dasyposoma* Brunner, Nouv. Syst. Blatt., p. 387.

After considerable study of the problem, we are now convinced that *Dasyposoma* is a synonym of *Hormetica*; the genotype and other species referred to, representing immature individuals of *Hormetica* in the later instars, as discussed below.

Hormetica ventralis Burmeister.

1838. *H[ormetica] ventralis* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 512. [Rio de Janeiro, [Brazil].]

1865. *D[asyposoma] nigra* Brunner; Nouv. Syst. Blatt., p. 388, p. XIII figs. 57 A to C.. [♂, ♀; Brazil.]

Tijuca, Rio de Janeiro, Brazil, 1 large juv. ♂.

This specimen agrees closely with an immature female in the same instar from Puerto Bertoni, Paraguay, recorded by Rehn as *Dasyposoma nigra* and apparently referable to *Hormetica atlas* Rehn, which species is very closely allied to the present.

Recent studies of a large series of both sexes, including adults and immatures, of *Hormetica apolinari* Hebard, from Colombia, have shown that in that species the early stages lacked pulvilli, the adults having well-developed pulvilli. Furthermore it was found that Saussure's *Dasyposoma marmorata* was based on the immature condition of a species of *Hormetica* closely related to *apolinari*.

The present material is, we believe, referable to *Hormetica ventralis*, and it is highly probable that Brunner's *Dasyposoma nigra* is based on the immature condition of this species; certain it is that the name is referable to this or one of the very closely related species of *Hormetica*.⁷⁴ The two immatures of Brazilian species at hand also lack arolia though the surface of the tarsi joint between the tarsal claws is swollen in this instar, apparently the last preceding maturity.

⁷⁴ Of these we have before us adults, representing both sexes, referred to *laevigata* Burmeister, *atlas* Rehn and *scrobiculata* Burmeister, which have been fully discussed by Rehn, Trans. Am. Ent. Soc., XLIII, p. 341, (1917).

As *nigra* has been designated gentotype of *Dasyposoma*, that genus in consequence falls in synonymy under *Hormetica*.

The coloration of the immature here recorded is as follows. Dorsal surface blackish brown, shining and polished except caudad, where minute subdenticulations roughen the surface; cingulate margins of pronotum, mesonotum and metanotum mars brown. Head mars brown paling to russet on occiput and mouthparts, eyes ochraceous-tawny, ocellar areas more buffy. Antennae with two proximal joints ochraceous-tawny, remainder dark mummy brown, except for a meso-distal annulus of light ochraceous-buff, occupying five joints. Limbs chestnut brown paling to ochraceous-buff on trochanters, bases of tibiae and ventral surfaces of tarsi. Ventral surface of abdomen shining and polished blackish brown, paling to ochraceous-tawny meso-proximad.

Length of body 29.4, greatest width of body (meso-caudad) 17, width of interocular space 3.9, length of caudal tibia 8.7 mm.

Parahormetica tumulosa Brunner.

1865. *P[arahormetica] tumulosa* Brunner, Nouv. Syst. Blatt., p. 385, pl. XII, figs. A to c'. [σ , φ ; Brazil.]

Minas Geraes, Brazil, 100 meters, 1 σ , 1 juv.

Passa-Quatro, Rio las Pedras, Brazil, 1000 meters, 1 σ , 1 φ , 2 juv.

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Exposed length of tegmen	Proximal width of tegmen
σ					
Minas Geraes, Brazil	28	10.7	14	6.9	6.7
Passa-Quatro, Minas Geraes, Brazil	30.3	11.6	14.4	7.7	6.3
φ					
Passa-Quatro, Minas Geraes, Brazil	28	9	12.7	5.8	5.6
Villa Lutezia, Misiones, Argentina	27.2	8.2	12.8	5.7	5

The immatures are very dark brown with limbs slightly paler and more reddish. Those recorded on page 299 from Argentina are solidly colored above, those from Minas Geraes having the pronotum ochraceous-buff in broad meso-caudal portion and mesonotum, metanotum and proximal abdominal tergites dresden brown in the same areas.

Parahormetica bilobata Saussure.

1864. *Parahormetica bilobata* Saussure, Rev. et Mag. de Zool., (2), XIV, p.

345. [φ ; Province of Minas Geraes, Brazil.]

Curityba, Paraná, Brazil, 1 σ .

Brazil, 1 φ , [Hebard Cln.].

The size of the specimens here recorded is much greater than that

given by Saussure. With a species subject to as great size variation as is shown by the two specimens, here associated without hesitation, as representing the same species, we feel that we are justified in referring this material to Saussure's *bilobata*. Saussure has described two decided color variations for that species. The two specimens before us agree closely in coloration.

Length of body ♂ 41.8, ♀ 36.7; length of pronotum ♂ 16.7, ♀ 11.7; width of pronotum ♂ 19.5, ♀ 16; length of exposed portion of tegmen ♂ 11.7, ♀ 8; width of tegmen ♂ 9.8, ♀ 7.7; width of interval between tegmina ♂ 7.5, ♀ 5.5 mm.

Section III. NORTHERN ARGENTINA.

The collection from this region, belonging to the Paris Museum, is large and to it have been added a considerable series from the the Hebard Collection, originally the property of Professor Lawrence Bruner. A total of 370 specimens has been recorded, including 22 genera and 37 species, of which 2 genera and 16 species are new.

As a result we have been able to study a much larger series of Argentinian Blattidae than has ever previously been assembled. The species recorded from the subtropical section of northern Argentina represent we believe, a fairly large proportion of the cockroaches which there occur.

Though the Blattidae of Argentina have been by no means neglected in past literature, the fact that over forty-five percent of the species here treated represent new forms, shows that this family has previously received scant attention by collectors. The extremely rich fauna of southern Brazil is continued into tropical northern Argentina, and it is probable that but a small proportion of the Blattidae of that region are as yet known.

Of particular interest are the brachypterous species of the genera *Cariblatia* and *Neoblattella*, the large number of species of the genus *Ischnoptera* (of which the species *caracana* shows extraordinary male dimorphism), the distinctive *Pseudischnoptera rhabdota*, the species of *Epilampra* in which the sexes show decided to very great dissimilarity and the five small species of the Corydiinae.

Eudromiella aglaia new species. Plate IX, figures 4 and 5.

Males of the present species agree closely with males of the genotype, *E. bicolorata* Hebard, described from Panama, differing in the more contrasting coloration, the pronotum with paired longitudinal

lines broader and with all but a caudal patch of the intervening area very dark, as well as in characters of the genitalia, particularly the distinctive specialization of the sixth tergite.

Type: ♂; Carcaraña, Santa Fé, Argentina. [Hebard Collection, Type no. 680.]

Size small, form graceful, structure delicate as characteristic of the genus. Interocular space about three-quarters as wide as that between antennal sockets. Ocellar spots distinct, ocellar areas rounding into interocellar area. Maxillary palpi moderately elongate, third and fifth joints of equal length, fourth joint slightly shorter. Lateral margins of face rather strongly convergent to clypeal suture. Pronotum broadly rounded, symmetrically trapezoidal, the greatest width near the caudal margin, that margin transverse, very broadly convex; surface of pronotum weakly convex. Tegmina and wings extending well beyond cercal apices. Tegmina with numerous, decidedly oblique, discoidal sectors. Wings with (7) heavily clubbed costal veins, with (6) complete branches of the ulnar vein, intercalated triangle small but distinct. Sixth tergite with a large projection meso-caudad, formed by two rounded ridges which unite cephalad, thus forming a V-shaped prominence, surface strongly concave cephalad and laterad of this prominence, supplied cephalad with numerous agglutinated hairs, directed caudad and reaching as far as the blunt apex of the prominence. Supra-anal plate broadly transverse. Paired plate beneath supra-anal plate large and unspecialized. Other concealed genitalic processes complex. Subgenital plate asymmetrical; sinistrad more produced than dextrad, with dextral portion curled upward and inward; styles inset, the dextral decidedly the more so. Sinistral style a flattened lobe, about twice as long as broad, expanding slightly to the truncate apex, the angles of which are broadly rounded. Dextral style somewhat similar but more elongate and slender and curled strongly dextrad toward apex, the base of which portion touches that of the sinistral style. Between the rather irregularly formed styles the median portion of the plate is triangularly produced, nearly filling the interspace between them. Limbs, armament, pulvilli and arolia as characteristic of genus.⁷⁵

Head with occiput ochraceous-buff tinged with tawny, deepening ventrad, with inter-ocular-ocellar area auburn and remaining portions of face blackish chestnut, ocellar spots light buff, antennae snuff brown, the first joint darker proximad. Pronotum with two broad longitudinal bars of deep chestnut brown, which broaden and diverge slightly caudad throughout their length, intervening area mars brown, except in a transverse, rectangulate area caudad which is ochraceous-buff; lateral portions of pronotum transparent, feebly tinged with buff. Tegmina with marginal field and marginal por-

⁷⁵ Described, Mem. Am. Ent. Soc., No. 4, p. 35, (1920).

tion of scapular field transparent, feebly tinged with buff, thence becoming suddenly rich chestnut brown, which gradually becomes more dilute distad and toward the costal margin and is there weakly tawny. Wings almost clear hyaline, showing a very faint tawny tinge toward the free margins of the anterior field and with enlarged portions of costal veins white. Abdomen with dorsal surface to sixth tergite blackish brown, narrowly margined laterad with ochraceous-buff, except that the sixth has a suffusion of blackish brown on each side. Cerci chestnut brown, shading to prouts brown distad and narrowly buffy proximad toward the internal margin. Ventral surface of thoracic segments and bases of trochanters chestnut brown, limbs light ochraceous-buff. Ventral surface of abdomen with lateral margins ochraceous-buff, proximad and laterad blackish brown, this leaving the median portion of the mesal section and all of the distal portion ochraceous-buff.

Length of body 9.7–9.3,⁷⁶ length of pronotum 2.7–2.7, width of pronotum 3.7–3.6, length of tegmen 10.3–9.9, width of tegmen 3–3 mm.

In addition to the type, a paratypic male, bearing the same data, is in the Hebard Collection.

Dasyblatta chopardi⁷⁷ new species. Plate IX, figures 6, 7 and 8.

This interesting species is distinguished from the genotype, *D. thaumasiä*, described on page 225, both known only from the male sex, by its smaller size, pale coloration, much wider interocular space and striking genitalia.

The genitalic specialization in these species is seen to represent a distinctive type, the two agreeing in general character of development.

Type: ♂; Colonia Florencia, Rio Tapenaga, Chaco, Argentina. [Paris Museum.]

In addition to the characters given in the generic description on page 224, the following are considered of specific value. Interocular space slightly over one-half occipital ocular depth, three-fifths that between antennal sockets; impressed punctae, the sockets of hairs, particularly conspicuous in the inter-ocular-ocellar area. Third joint of maxillary palpi four-fifths as long as the large fifth joint, slightly longer than the fourth joint. Hirsute tegmina subcoriaceous in appearance, due to the fact that the hairs are invisible except under the microscope; area of dextral tegmen, concealed when at rest, hairless; discoidal sectors (9–10) best termed longitudinal, though toward the sutural margin the last of those in the sinistral tegmen is weakly oblique to that margin, while toward the sutural margin several in the dextral tegmen are slightly irregular.

⁷⁶ The measurements of the type are given first.

⁷⁷ In honor of our friend, Dr. Lucien Chopard.

and moderately oblique. Abdominal tergites apparently much as described for *thaumasia* on page 225.⁷⁸ Subgenital plate curled upward and inward sinistro-proximad beside the base of the supra-anal plate and there with a small rounded node, produced caudad beside the lateral margin of the supra-anal plate, its apex armed with two straight chaetiform spines directed caudad. Supra-anal plate three-fifths as long as its proximal width, weakly chitinous in distal portion, this area defined from the proximal area by a delicate but distinct, straight, transverse sulcus, lateral margins feebly concave, not convergent to bases of cerci, straight and strongly oblique to within these, the remaining portion roundly produced, with median emargination feebly suggested. Subgenital plate with sinistro-proximal portion specialized as described above, beyond this with surface moderately convex so that the very broadly and irregularly convex margin nearly touches the cercus, bearing on its internal surface at the margin beneath the cercus a stout straight spine, directed dorso-mesad, this section of the margin terminating at the small simple sinistral style, situated just within the sinistral cercus; this style cylindrical, about twice as long as broad, directed dorso-mesad; beyond this point the margin is very deeply and roundly concave to the dextral style, similar but smaller and more tapering, situated slightly sinistrad of the median point and directed dextro-caudad, the internal surface of the plate at the base of this style bearing two stout spines of equal length curved caudad; remaining large dextral section of the plate curled inward beneath dextral cercus and supra-anal plate to slightly beyond this point, the dorsal outline of the projection triangular, with apex bluntly rounded. Concealed genitalia complex, the paired plate beneath the supra-anal plate apparently developed into projections armed with minute teeth.⁷⁹

General coloration of entire insect ochraceous-buff. Vertex to between ocelli suffused with dresden brown. Eyes blackish brown. Ocelli light buff. Disk of pronotum with a tawny orange tinge. Tegmina showing an exceedingly faint and even tinge of buckthorn brown.

Length of body 9.4, length of pronotum 2.4, width of pronotum 3.2, length of tegmen 9.8, width of tegmen 2.9, length of caudal tibia 3.8, length of caudal metatarsus 1.6 mm.

Though even less striking in general appearance than *thaumasia*, this unique specimen also represents actually one of the most remarkably specialized forms of the Blattidae known to us.

*Cariblatta mesembrina*⁸⁰ new species. Plate IX, figure 16.

This species shows the greatest tegminal reduction known in the genus. In *C. lutea minima* Hebard, from the United States, the

⁷⁸ The sinistral portion of the eighth tergite is damaged in this specimen.

⁷⁹ Dissection of this unique individual is inadvisable.

⁸⁰ From μεσημβρινά = Southern.

tegmina are reduced sufficiently to leave exposed the distal portion of the abdomen, but in that race these organs narrow to the rather sharply rounded apices. In *mesembrina* the tegmina are truncate distad, the costal margin rounding very broadly into the transverse distal margin, so that these organs leave almost the entire dorsal surface of the abdomen exposed.

Though apparently nearest *lutea minima*, the present species is seen to approach that race only in features governed by reduction in the organs of flight and to be derived from a different phylum, the development of the pronotal picturing and cephalic marking being distinctive.

From the pronotal picturing, we believe it best to place the species in linear arrangement after *C. fossicauda* Hebard, described from Trinidad.

The adult male probably shows distinctive genitalic features, as is indicated by the immature examples of that sex at hand.

Type: ♀; Carcaraña, Santa Fé, Argentina. [Hebard Collection, Type No. 681.]

Size small, form moderately robust for the genus of very small and moderately slender species. Head with interocular space very slightly wider than that between antennal sockets.⁸¹ Ocellar spots poorly defined. Pronotum with surface evenly and weakly convex, greatest width near caudal margin, that margin transverse, showing practically no convexity. Tegmina strongly reduced, overlapping but not reaching beyond median segment, costal margin rounding very broadly into transverse distal margin, sutural margin straight, rounding suddenly into distal margin a short distance beyond the anal field, with longitudinal trend of discoidal sectors discernible. Wings minute aborted pads, reaching to base of median segment. Supra-anal plate triangularly produced with immediate apex minutely emarginate, length one-third proximal width. Subgenital plate scoop-shaped, projecting moderately mesad, the lateral portions raised so that the plate appears broadly V-shaped mesad when seen from the rear. Ventro-cephalic margin of cephalic femora armed with a row of spines which decrease rapidly and irregularly distad, terminated by two elongate spines; ventro-caudal margin armed with two widely spaced spines meso-distad and a single distal spine. Other ventral femoral margins moderately supplied with spines. Succeeding tarsal joints two-thirds as long as caudal metatarsus, the four proximal tarsal joints supplied with moderately well-developed pulvilli. Large arolia present between the very feebly specialized, symmetrical tarsal claws, these claws

⁸¹ This is slightly narrower than in *lutea minima* and appreciably narrower than normally in the West Indian genotype, *C. delicatula* (Guérin).

having lost an internal flange and with weak serrulations of ventral margin visible only under very high magnification.⁸²

Head with occiput ochraceous-buff, a broad band of prouts brown between the eyes, the ventral margin of which is broadly concave, succeeded by a slightly broader band of white, in which laterad are located the ocellar spots and the ventral margin of which is transverse, below this the face is heavily suffused with prouts brown, the remaining portions ochraceous-buff, with flecks of prouts brown below the antennae, which send an oblique ray toward the median portion of the face. Antennae ochraceous-buff, with slight suffusions of darker on the three proximal segments. Maxillary palpi ochraceous-buff, the last joint tinged with tawny and becoming cinnamon brown distad. Pronotum with lateral portions transparent, very faintly tinged with buff; disk ochraceous-buff, beautifully and heavily pictured with cinnamon brown, as figured. Tegmina transparent, very faintly tinged with buff. Dorsal surface of abdomen blackish brown and cinnamon brown, with lateral margins irregularly bordered with ochraceous-buff and three rows of irregular spots of the same color. Cerci ochraceous-buff, ventral surface and dorsal surface proximad suffused with prouts brown, the latter with a fleck of prouts brown meso-distad. Limbs ochraceous-buff, the cephalic femora delicately margined dorsad and all the dorsal spines of the tibiae with flecks at their bases of prouts brown. Abdomen with ventral surface bordered narrowly laterad with light ochraceous-buff, this margined internally with prouts brown, within which is a fleck of the same color on each segment, remaining portions ochraceous-buff, except for a broad medio-longitudinal band of blackish chestnut brown, which expands caudad on the subgenital plate.

Length of body 7, length of pronotum 2.1, width of pronotum 3, length of tegmen 2.7, width of tegmen 2.1 mm.

In addition to the type, a large immature male bearing the same data and a smaller immature individual from Ceres, Santa Fé, Argentina, are in the Hebard Collection.

Neoblattella conspersa (Brunner) Plate IX, figure 20.

1865. *Ph[yllodromia] conspersa* Brunner, Nouv. Syst. Blatt., p. 106. [♂, Brazil.]

Colonia Florencia, Rio Tapenaga, Chaco, Argentina, 1 ♂, 1 ♀.

Villa Lutecia, near San Ignacio Misiones, Argentina, 4 ♀, 1 juv.

The species has been once previously recorded from Argentina, by Rehn from the Misiones. The male genitalia are here figured

⁸² The specialization of the tarsal claws was not recognized at the time the genus *Cariblatia* was described. It is apparent that in degenerate forms this specialization is much reduced or obsolete. In *delicatula* and other long-winged species, a flange, minutely but conspicuously serrulate, is found, but in *lutea lutea* and *lutea minima* this has entirely disappeared, leaving no trace even of serrulation.

for the first time, showing the contrasting differences between *conspersa* and *platystylata*, described on page 229.

The females of these species are separated with difficulty, as commented upon under *platystylata*. In the present insect the lateral margins of the female subgenital plate on each side of the meso-distal portion are produced dorsad in small plates, the truncate apices of these armed with a regular series of (usually 7) equal, chaetiform spines. At the base of these plates, within the anal chamber on the dorsal surface of the subgenital plate, are situated projections of similar character, but more reduced and bearing a lesser number of spines. The size and form of these appendages is subject to some individual variation. In all but these two species of the genus *Neoblattella* known to us, the female subgenital plate shows no trace of such specialization.

The males at hand have the meso-distal portion of the supra-anal plate showing some individual variation. In this sex the subgenital plate is immaculate, the dark marking of the ventral surface of the abdomen not extending that far caudad; this is true for the Argentinian females also, but not for the more intensively colored females from Igarapé-Assú, Pará, Brazil.

MEASUREMENTS (*in millimeters*).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
Bonito, Pernambuco, Brazil (2)	9.6-10.7	2.6-2.8	3.6-3.7	11.3-11.4	3.3-3.4
Igarapé-Assu, Pará, Brazil	10.8	2.7	3.3	11.6	3.2
Contamano, Rio Ucayali, Peru ⁸³	9.7	2.8	3.3	11.4	3.1
Colonia Florencia, Chaco, Argentina	11.8	3.1	4.1	12.3	4
Misiones, Argentina	11	3	3.8	12.8	3.8
♀					
Igarapé-Assu, Pará, Brazil (5)	9.1-10.3	2.7-2.8	3.4-3.7	10.4-11	3.3-3.4
Sapucay, Paraguay ⁸⁴	9.8	2.8	3.5	10	3.2
Colonia Florencia, Chaco, Argentina	—	3.2	4.2	12.2	3.8
Villa Lutecia, Misiones, Argentina (4)	11-12.5	3-3.1	4-4	12.4-12.6	4-4

Distinctly greater size is shown by the Argentinian series, apparently a geographic feature.

⁸³ This specimen, in the collection of the Academy of Natural Sciences, was taken October to December, 1912.

⁸⁴ This specimen, belonging to the United States National Museum, was recorded as *Blattella conspersa* by Caudell, the individual being mistaken for a male, Jn. N. Y. Ent. Soc., XII, p. 183, (1904).

Neoblattella puerilis (Rehn)

1915. *Ceratinoptera puerilis* Rehn, Proc. Acad. Nat. Sci. Phila., 1915, p. 273, fig. I. [♂; Misiones, Argentina.]

The type of this species now before us, shows that it agrees in all valid generic features with the genus *Neoblattella*. Species of that genus, however, showing decidedly reduced tegmina, were previously unrecognized.

The insect is clearly of more recent common ancestry with the genotype, *N. adspersicollis* (Stål), than many of the species which we believe to be properly referable to *Neoblattella* and it would appear advisable to assign it to the *Adspersicollis* Group, though additional evidence may show it and the species described below to belong to a distinct, though closely related, group.

The broad form; arrangement of dark punctae on face and disk of pronotum; simple, straight, elongate similar styles; large pulvilli, and decided serration of the flange of the tarsal claws, are all features shared by *adspersicollis*.

The smaller spines of the ventro-cephalic margin of the cephalic femora are irregularly interspersed with a few (3 and 4) chaetiform spines, showing some slight divergence from the condition usually shown by the species of the genus.

Neoblattella tapenagae new species. Plate X, figure 8.

Close relationship to *N. puerilis* (Rehn) is shown. Compared with the male type of that species, females are readily distinguishable by the richer coloration and distinctive markings of head, pronotum and tegmina, the type "B" armament of the ventro-cephalic margins of the cephalic femora and even larger pulvilli.

This is the first case in our studies of the Blattellae where, in the same genus, the armament of the ventro-cephalic margin of the cephalic femora is found to be of type "A" in most species, but as clearly of type "B" in one case. Transitional stages are shown in *N. puerilis* (Rehn) and *N. janeirae*, described on page 226. This difference, we feel we can safely state, may be used as a criterion for generic separation in most genera of the Blattellae, but the characterization of *Neoblattella*, much the largest genus of the group, must be changed to include both types.

Type: ♀; Colonia Florencia, Rio Tapenaga, Chaco, Argentina. [Paris Museum.]

Size large, form very broad for the genus. Interocular space wide, slightly narrower than that between antennal sockets. Ocellar spots moderately large, distinct, these areas rounding broadly into

the adjacent portions. Lateral margins of cheeks weakly convergent ventrad. Maxillary palpi moderately short for the genus, fourth joint nearly as long as third, large fifth joint three-quarters as long as fourth. Tegmina decidedly reduced, covering slightly less than half the dorsal surface of the abdomen; costal margin very gently arcuate, broadly rounding distad into the broadly rounded distal margin, sutural margin nearly straight, rounding much more suddenly, though broadly, into the distal margin; venation distinct, the caudal margin cutting the veins abruptly, the discoidal sectors (3 to 6 in the series) cut off before reaching a truly longitudinal direction, so that the portions shown appear very weakly oblique to the sutural margin⁸⁵. Wings vestigial, extending to the caudal margin of the metanotum. Supra-anal plate two-fifths as long as its basal width, lateral margins broadly concave-convergent to distal portion, which is bilobate, due to a moderate meso-distal emargination (which is sharp in the type, rounded in the paratype). Subgenital plate simple, large, weakly produced, the free margin weakly concave beneath the cerci and mesad, weakly convex between these portions. Ventro-cephalic margin of cephalic femora armed with (4 to 6; in the case of the greater number, with the last two considerably smaller) heavy, elongate, well-spaced proximal spines, succeeded by a row of (11 to 15) minute, closely placed chaetiform spinulae, terminated by three heavy spines, elongates in increasing ratio distad. Pulvilli of four proximal tarsal joint, unusually large for the genus, occupying the entire ventral surfaces of the three tarsal joints succeeding the metatarsus, apices acute, Tarsal claws symmetrical, well-developed flanges with (5) teeth decided. Moderately well-developed arolia present.

Head with vertex light ochraceous-tawny with an orange tinge, a large transverse suffusion of chestnut-brown between the ventral portions of the eyes and dorsal portions of the antennal sockets, ocellar spots and face ochraceous-buff, the latter with a narrow, transverse suffusion of chestnut-brown above the clypeus, which broadens on the cheeks. In one paratype there is an additional narrower transverse suffusion of the same color between these. Pronotum in median portion light ochraceous-tawny with an orange tinge, this bordered on each side by a longitudinal suffusion of chestnut-brown, which broadens caudad; disk with light flecks of chestnut brown,⁸⁶ three in an oblique row on each side mesad, two caudad; lateral portions transparent, faintly tinged with buffy, margins themselves buffy with an orange tinge. Tegmina showing a continuation of the pronotum coloring, the suffusion of the humeral

⁸⁵ This is not true of *puerilis*, in which the tegminal reduction is as great, but the brief portions of the discoidal sectors are plainly longitudinal to the sutural margin. It would appear that reduction of these organs affects the direction of the veins more in some species than in others.

⁸⁶ In one paratype of more intensive coloration these flecks are supplemented by small, weak suffusions and lines, giving a more nearly pictured appearance.

trunk a continuation of the darker pronotal areas, beyond this with veins paler, dresden brown, but intervening areas chestnut-brown. Mesonotum and metanotum ochraceous-buff. Abdomen dorsad shining blackish brown, the broader tergites narrowly margined laterad with ochraceous-buff and with weak, paired, small buffy flecks mesad. Cerci blackish brown, becoming buffy disto-dorsad. Limbs light ochraceous-buff with an orange tinge, very narrowly marked with prouts brown at bases of spines, tarsal joints each heavily suffused with prouts brown distad. Ventral surface of abdomen shining blackish brown, narrowly margined laterad with ochraceous-buff, this including the proximal portion of the subgenital plate.

In a large immature female before us the coloration is much darker. Dorsal surface, except hyaline lateral portions of thoracic segments, which are tinged with dresden brown, blackish brown, this slightly deeper laterad, with slightly paler flecks on the broader abdominal tergites.

Length of body⁸⁷ 13.1–13.3, length of pronotum 4.1–4.2, width of pronotum 5.9–5.9, total length of tegmen⁸⁸ 6.9–6.7, width of tegmen 4–4.2, length of caudal tibia 5.3–5.5 mm.

In addition to the type, a paratypic female and a large immature female, bearing the same data, as well as a paratypic female, without further data than "Gran Chaco," have been examined.

Blattella germanica (Linnaeus)

1767. [*Blatta*] *germanica* Linnaeus, Syst. Nat., Ed. XII, p. 668. [Denmark.]

Villa Lutecia, near San Ignacio, Misiones, Argentina, March and April, I ♀.

Rio Paraná, IX, 29, 1897, 2 ♂, 2 ♀ with oothecae, [Hebard Cln.].

Buenos Aires, Argentina, 1 juv. ♂.

Litoblatta brasiliensis (Brunner) Plate X, figures 14, 15, 16 and 17.

1865 *I[schnoptera] brasiliensis* Brunner, Nouv. Syst. Blatt., p. 130, pl. III fig. 12. [♂ Brazil.]

Colonia Florencia, Rio Tapenaga, Chaco, Argentina, 1 ♂.

Icaño, Santiago del Estero, Argentina, 14 ♂, 3 ♀.

Las Garzas, Rio Las Garzas, Santa Fé, Argentina, 1 ♂.

Cruz del Eje, Cordoba, Argentina, 1 ♀, [Hebard Cln.].

Cordoba, Cordoba, Argentina, (F. Schultz), 2 ♂, [Hebard Cln.].

San Rafael, Mendoza, Argentina, 680 meters, February, 1 ♂, 1 ♀.

The new genus *Litoblatta* is erected to include this species on page 237. We have there placed *Loboptera laurenziana* Giglio-Tos in synonymy as representing the female sex of this species.

⁸⁷ The measurements of the type are given first.

⁸⁸ The exposed length of these organs is slightly over one millimeter less.

MEASUREMENTS (*in millimeters*).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen ⁸⁹	Width of tegmen
Passa-Quatro, Minas Geraes, Brazil	19	4.1	4.8	19.4	5.4
Sapucay, Paraguay	16	3.7	4.4	13.6	4.4
Colonia Florencia, Chaco, Argentina	12.7	3.2	4	13.8	4.1
Icaño, Santiago del Estero, Argentina	11.8	2.9	3.8	11.9	3.3
Icaño, Santiago del Estero, Argentina	13.2	2.8	3.8	13	3.7
Icaño, Santiago del Estero, Argentina	14	3.9	4.7	16	4.1
Icaño, Santiago del Estero, Argentina	17.6	4.3	5.8	19	5.2
Icaño, Santiago del Estero, Argentina	18.8	4.3	6.2	18.8	5.2
San Rafael, Mendoza, Argentina	17	3.8	4.9	19	5.1
♀					
Icaño, Santiago del Estero, Argentina	14	4.8	6.3	2.7	2.2
Icaño, Santiago del Estero, Argentina	18	5.1	7	3.1	2.8
Icaño, Santiago del Estero, Argentina	19	5.7	7.4	3.1	2.7

As indicated above, the series of this species from the vicinity of Icaño, shows an exceptional amount of individual size variation.

Ischnoptera ignobilis Saussure

1864. *Ischnoptera ignobilis* Saussure, Rev. et Mag. de Zool., (2), XVI, p. 313. [♂, nec ♀;⁹⁰ Buenos Aires, Argentina.]

1869. *Ischnoptera vilis* Saussure, Rev. et Mag. de Zool., (2), XXI, p. 112. [[♂], Argentina.]

1897. *Loboptera borellii* Giglio-Tos, Boll. Mus. Zool. Anat. comp. Univ. Torino, XII, No. 302, p. 3. [♀; Caiza and San Francisco, Bolivia; Tala, Argentina.]

Gran Chaco, Argentina, 7 ♂, 1 ♀.

Colonia Florencia, Chaco, Argentina, 4 ♂, 1 juv.

Icaño, Santiago del Estero, Argentina, 14 ♂, 4 ♀.

Tucuman, Tucuman, Argentina, 3 ♀, 2 juv.

Las Garzas, Rio Las Garzas, Santa Fé, Argentina, 3 ♂.

Carcaraña, Santa Fé, Argentina, 8 ♂, 4 ♀, 10 juv., 1 ootheca, [Hebard Cln.].

Buenos Aires, Buenos Aires, Argentina, February, 1 juv.

Cordoba, Cordoba, Argentina, (F. Schulz), 3 ♂, 1 ♀.

Montevideo, Uruguay, 3 juv.

⁸⁹ The exposed length of the tegmen is given for females.

⁹⁰ It appears almost certain that a male, possibly with subgenital plate damaged or missing, was described by Saussure; which specimen he recorded as a female.

After careful study of the series at hand, the material previously recorded as *I. vilis* Saussure from Paraguay and the Argentine, and the literature, we are convinced that a single variable species is represented. In coloration, a series of males from Sapucay, Paraguay, agree with the male type of *vilis*, described from Corrientes, Argentina, in having the lateral portions of the pronotum slightly paler and more reddish than the dark brown remaining portions. Three Paraguayan males, however, are at hand with pronotum solidly colored. In the Argentinian material all of the males have the pronotum solidly colored, varying from dark brown to rather light reddish brown. In all specimens showing the bicolored pronotal condition before us, the femora are very dark brown the remaining portions very contrastingly colored; this limb coloration appears in the Argentinian material, but shows slightly less decided contrast, varying to a condition in which the limbs are uniform light brown. This latter condition is shown by the majority of the Argentinian males, as well as by two of the three Paraguayan males with unicolorous pronotum. The vertex is individually dark or pale.

In the concealed genitalia we find the paired plate beneath the supra-anal plate to be very large, the dextral plate much the larger, with periphery rounded, bearing along its ventral margin numerous spiniform hairs and near the distal portion of this margin with a small, irregular, chitinous area, flanked by a chitinous spine directed distad. In the entire Paraguayan series this spine, though variable in heaviness and length, is free and averages heavier than in the Argentinian material showing that condition. In other Argentinian specimens the spine is indicated only as a sharp, slender, chitinous projection along the external margin of the subchitinous area, which is not free. It would appear to be true that the Paraguayan material shows incipient racial differentiation, but this has not, in our opinion, yet reached either sufficient degree or stability to warrant nominal recognition.

Comparison of the females before us, with Giglio-Tos' description of *Loboptera borellii*, shows that name to be based on material representing that sex of the present species.

MEASUREMENTS (in millimeters).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
♂					
Sapucay, Paraguay (10)	16-17	4-4.2	5.5-5.9	16.7-17.3	5-5.5
Carcaraña, Argentina (9)	12-15	3.2-3.8	4.4-5	14-16.7	4.1-5.3
♀					
Tucuman, Argentina (3)	17-17.2	5-5.3	7.3-7	5-5.1	3.3-3.4
Carcaraña, Argentina (4)	14-15.6	4.3-4.5	5.9-6.2	3.6-4.7	2.8-3
Cordoba, Argentina	14.3	4.3	6	3.9	2.9

The elongate triangular, pad-like, lateral tegmina of females of the present species show a differentiation in this sex somewhat similar to that developed in *I. deropeltiformis* (Brunner). These species, however, do not belong to the same species group, as stated by us in 1917.⁹¹ One striking feature of difference between the females of these species is that in those of *ignobilis* vestigial wings are present as minute pads beneath the apices of the tegmina, their very apices alone sometimes projecting and scarcely extending beyond the caudal margin of the metanotum.

The Gran Chaco specimens average large for the species, all but one having the pronotum solidly blackish brown. A single specimen has the pronotum dull mahogany red, becoming bay caudad; the tegmina, as in the others, chestnut tinged with bay proximad.

The individuals in the Icaño series average smaller, all having the pronotum solidly colored, blackish brown to chestnut brown, the tegmina agreeing with the pronotum in coloration except in two, which have the pronotum very dark but these organs deep chestnut.

Ischnoptera carcarana new species. Plate XI, figures 1, 2 and 3.

This is a small species, showing, however, closer relationship to the much larger *I. ignobilis* Saussure than to the numerous other small species of the genus.

The general coloration is darker than in *ignobilis*; the limbs strikingly bicolored, as is sometimes the case in that species. The concealed male genitalia are distinctive, while in the brachypterous males and the females the triangular lateral tegminal pads are smaller than in females of *ignobilis* and wing pads are not present.

A feature which we have never hitherto met with in studying the Blattidae is the complete and non-intergrading dimorphism developed in the male sex of this species. Two males before us have fully developed tegmina and wings. Three males show the general contour, tegmina represented by minute lateral pads and complete absence of wings, such as is true for the two females at hand.

Though certain species are known to develop all degrees of tegminal and wing reduction, from a fully developed to a much reduced type, it would appear unlikely that intermediate conditions occur in males of *carcarana*, so extreme and clear cut are the macropterous and brachypterous conditions shown. The brachypterous type, in fact, shows for both sexes a retention in the adult con-

⁹¹ Mem. Am. Ent. Soc., No. 2, p. 62.

dition of many features of the early stages. The macropterous males show the usual differentiation from the early stages developed by adults of the normal macropterous species of *Ischnoptera*.

The close agreement of the brachypterous males and females offers ample evidence that they represent a single species. The macropterous males are assigned to the same species through their close similarity in genitalic characters, limb armament and coloration, the differences shown being wholly attributable to the factors discussed above.

Type: ♂; Carcaraña, Santa Fé, Argentina. [Hebard Collection Type no. 704.]

Size small, form rather slender for the genus. Interocular space broad, as wide as that between the antennal sockets. Ocellar spots moderately large, though small and poorly defined for the genus, the area which they occupy not sharply delimited from the interocular-ocellar and rounding into it. Maxillary palpi with fourth joint three-quarters as long as third, third joint three-quarters as long as the elongate fifth joint. Latero-caudal sulci of pronotal disk deep and strongly defined. Tegmina and wings extending well beyond the cercal apices. Wings with a small intercalated triangle, ulnar vein with (3) incomplete and (1) complete branches. Dorsal surface of abdomen specialized as characteristic of genus. Supra-anal plate symmetrical, trapezoidal with angles rounded, width between cerci about twice length, surface weakly concave except above cercal bases and meso-distad on each side where it is weakly convex, distal margin transverse, showing weak lateral convexity and very broad and weak median emargination, so that a sub-bilobate condition is developed; ventral surface with a very delicate transverse ridge between cercal bases and supplied distad with elongate hairs. Paired plate beneath supra-anal plate developed into very large, flattened lobes; the sinistral forming an unarmed transverse ridge toward its dorsal margin, the dextral with a heavier transverse ridge mesad, this ridge, as well as the portion of the plate ventrad, armed with a number of minute but stout spines. Titillator elongate and very slender, widening slightly before the acuminate apex but unspecialized. Subgenital plate with surface strongly convex, except in produced area where it is weakly concave; sinistral margin oblique and rather strongly concave to median portion, dextral margin oblique and more broadly concave a greater distance, the portion of the margin between being short, straight, transverse. Sinistral style situated on sinistral margin mesad of the cercus, simple, cylindrical, weakly tapering to the sharply rounded apex, with shaft weakly decurved, covered with coarse hairs as is the subgenital plate. Dextral style situated mesad on the short, transverse distal margin, very similar but slightly shorter, with decurvature slightly greater and apex slightly blunter

and armed with minute spines. Armament of limbs as characteristic of the genus. Four proximal tarsal joints supplied distad with small but readily observed pulvilli. Moderately well developed arolia present between the slender, simple, symmetrical tarsal claws.

Allotype: ♀; Buenos Aires, Buenos Aires, Argentina. [Paris Museum.]

Agrees with macropterous male type except in the following characters. Size larger, form broader. Interocular space distinctly wider than that between antennal sockets. Ocellar spots smaller, ocellar areas not differentiated. Pronotum with latero-caudal sulci of disk obsolete; greatest width at latero-caudal angles; caudal margin truncate, very broadly convex, transverse. Tegmina minute, rounded triangular, broad, lateral pads, extending only slightly beyond caudal margin of mesonotum, but with venation distinct. Wings absent. Supra-anal plate slightly less than half as long as its basal width, triangularly produced with apex sharply rounded. Subgenital plate convex, with free margin broadly convex. Limbs slightly heavier.

Three brachypterous males, which we have discussed above, agree in all but genitalic features with the allotype, except that the interocular space is only slightly wider than that between the antennal sockets.

Head shining blackish, ocellar spots buffy, palpi blackish chestnut brown, mouth-parts cinnamon brown. Pronotum solidly blackish. Tegmina of male blackish and opaque proximad, weakening mesad, becoming translucent tinged with prouts brown, and transparent distad, very weakly tinged with prouts brown, as is the area of the dextral tegmen which is concealed when at rest. Tegmina of female blackish and opaque. Body, cerci, coxae and femora blackish chestnut brown. Tibiae and tarsi tawny.

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
♂					
Carcaraña, <i>type</i>	10	2.9	3.7	10.3	3
Carcaraña, <i>paratype</i>	—	2.7	3.9	2.1	1.8
Rosario, <i>paratype</i>	11.3	2.9	3.8	10.3	3.1
Buenos Aires, <i>paratype</i>	9.6	2.8	4	1.9	1.9
Buenos Aires, <i>paratype</i>	10.4	3	4.2	2.1	1.85
♀					
Buenos Aires, <i>allotype</i>	12.8	3.6	4.9	2.3	2
Buenos Aires, <i>paratype</i>	11.3	3.3	4.4	2	1.7

Specimens Examined: 13; 5 males, 2 females and 6 immature individuals.⁹²

⁹² Two immature individuals from Montevideo, Uruguay, are before us, which represent this or a very closely related species. They differ from the Carcaraña juveniles in having the limbs almost unicolorous, the tibiae distad and the tarsi being only slightly less dark than the other portions, which are black.

Carcaraña, Santa Fé, Argentina, 2 ♂, *type* and *paratype*, 4 juv. ♂, 2 juv. ♀, [Hebard Cln.].

Rosario, Santa Fé, Argentina, (H. Stempelmann,) 1 ♂, *paratype*, [Hebard Cln.].

Vicinity of Buenos Aires, Buenos, Argentina, February, 2 ♂, 2 ♀, *allotype* and *paratype*, [Paris Museum].

Ischnoptera argentina new species. Plate XI, figures 4, 5 and 6.

This species is very closely related to *I. rufa* (De Geer), differing in important features of the male genitalia, the distinctly less reddish general coloration of the males and differently shaped female supra-anal plate.⁹³

It is probable that it was the present, or a related undescribed species, which Giglio-Tos has recorded as *rufa* from San Lorenzo, Argentina and San Francisco and Caiza, Bolivia.⁹⁴

Rehn's records of *rufa* from Misiones, Argentina, are based on very light specimens of *I. ignobilis* Saussure.⁹⁵

Type: ♂; San Nicolas, Buenos Aires, Argentina. November 5, 1897. [Hebard Collection Type no. 671.]

Size medium large, form moderately stout. Head with interocular space appreciably narrower than that between the ocelli, (varying in male paratypes to nearly that width). Ocelli distinct, flattened surfaces of ocellar areas slanting rather strongly mesad, very slightly more so than in *rufa*. Maxillary palpi rather short. Pronotum with discal sulci decided. Tegmina and wings elongate, more so than in *rufa*, much as in *I. angustifrons* Hebard. Supra-anal plate produced; lateral margins weakly convergent, distal margin transverse, three-quarters length of plate; surface subchitinous in a large transverse oval, just proximad of distal margin; ventral surface with very short, stout bristles, near sinistral margin and on a moderately prominent convex area adjacent to the dextral margin of the subchitinous area. Paired plate beneath supra-anal plate specialized: at base of sinistral style produced mesad in a chitinous recurved spine, the dorso-proximal portion of which is subchitinous; at base of dextral style produced mesad in a heavy shafted, chitinous spine, over twice as long, directed caudad and then curving broadly inward to its aciculate apex. Titillator with apex similarly special-

⁹³ Though the female supra-anal plate varies in having the lateral margins straight convergent to rather broadly concave convergent in *rufa* (upon which apparent difference was based Saussure's *consobrina*, a synonym of *rufa occidentalis* Saussure), the lateral emargination of this plate shown by females of *argentina* is of a different quality and much more decided than is shown by any of the large series of the females of the races of *rufa* before us.

⁹⁴ Boll. Mus. Zool. Anat. comp. Univ. Torino, XII, No. 302, p. 5, (1897).

⁹⁵ Proc. Acad. Nat. Sci. Phila., 1913, p. 276, (1913); *ibid.*, 1915, p. 272, (1915).

ized to that of *rufa*, but shorter and proportionately broader. Subgenital plate strongly asymmetrical as characteristic of genus, much as in *rufa* except that the larger style is slightly heavier, less than three times as broad as long and not twice as long (varying in the series to nearly twice as long) as the unarmed sinistral style.

Allotype: ♀; same data as type. [Hebard Collection.]

Similar to male in ambisexual characters except those of coloration. Size larger, form appreciably broader with pronotum more ample. Head with interocular space slightly narrower, (varying in the series to slightly wider) than that between the ocelli. Pronotum with discal sulci weak. Tegmina and wings broader than in male, surpassing the cercal apices (to different degrees in the series but never by as much as in the opposite sex). Supra-anal plate with lateral portions of free margin very strongly convergent and broadly convex to median produced portion, this portion with margin convex, nearly forming a semicircle (one paratype shows slightly greater convexity at the apex than elsewhere in the margin of the produced portion). Subgenital plate convex, free margin broadly convex, except below cerci, where it is broadly concave.

MEASUREMENTS (*in millimeters*).

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
Paraguay	13	3.7	4.6	16.2	4.8
San Nicolas, Argentina, <i>type</i>	14.3	3.7	4.8	15.9	7.4
San Nicolas, Argentina, <i>para-</i>	13-15	3.6-4.1	4.7-5.7	15.8-16	4.6-5
<i>types</i> (3)					
Carcaraña, Argentina	12.5	3.4	4.7	15.7	4.7
Cordoba, Argentina	12.5	3.2	4.6	15	4.6
♀					
San Nicolas, Argentina, <i>allo-</i>	18	4.7	6	17.8	5.2
<i>type</i>					
San Nicolas, Argentina, <i>para-</i>	15-18.7	4-5	5-6.2	15.5-16.8	4.4-5.2
<i>types</i> (10)					
Carcaraña, Argentina (2)	14.8-16.7	3.8-4.3	5.1-5.4	15.7-17.2	4.7-5.2
Icaño, Argentina	16.3	4.7	6.1	17.3	5.2

Coloration. Male. Head with vertex and inter-ocular-ocellar area auburn, ocelli warm buff, other portions cinnamon-buff showing a very faint tawny tinge. Antennae with proximal joints cinnamon-buff, remaining portions bister. Pronotum light ochraceous-tawny. Tegmina ochraceous-buff, tinged with tawny except in marginal fields. Dorsal surface of abdomen blackish chestnut brown. Ventral surfaces of thoracic segments and all of limbs cinnamon-buff showing a very faint tawny tinge, spines tawny. Ventral surface of abdomen cinnamon brown, gradually deepening to blackish chestnut brown laterad and distad.

Female similarly colored except that the pronotum is tawny, the tegmina tawny, except in marginal field, which is ochraceous-tawny. The series of females at hand shows, a considerable amount of intensification and recession of color, all, however, being more tawny

than the more uniformly colored males. As a result, there is a color contrast between the sexes, a condition which does not occur in *rufa*. In the maximum intensive female (Carcaraña) the vertex to below the ocelli is rich deep chestnut brown. The pronotum is similarly colored, becoming almost black in the mesal portion. The tegmina are ochraceous-tawny, weakly suffused with chestnut brown proximad, with marginal field buckthorn brown showing a weak tawny tinge.

Specimens Examined 19; 7 males and 12 females.

Paraguay, 1 ♂, [Hebard Cln.].

Colonia Florencia, Rio Tapenaga, Chaco, Argentina, 1 ♂, [Paris Museum].

San Nicolas, Buenos Aires, Argentina, November 5, 1897, 4 ♂, 11 ♀, *type, allotype, paratypes*, [Hebard Cln.].

Carcaraña, Santa Fé, Argentina, 1 ♂, 2 ♀, (1 with ootheca), [Hebard Cln.].

Icaño, Santiago del Estero, 1 ♀, [Paris Museum].

Cordoba, Cordoba, Argentina, (F. Schulz), 1 ♂, [Hebard Cln.].

***Ischnoptera bilunata* Saussure.**

1869. *I[schnoptera] bilunata* Saussure, Rev. et Mag. de Zool., (2), XXI, p.

111. [♂; Chiquitos, [Bolivia].]

Sapucay, Paraguay, February 10, 1901, (W. T. Foster), 1 ♂,⁹⁶ [U. S. N. M.].

Gran Chaco, Argentina, 2 ♀, [Paris Museum].

Colonia Florencia, Rio Tapenaga, Chaco Argentina, 1 ♂, 1 ♀, [Paris Museum].

La Palisa del Bracho, Laguna Mamaita, Santiago del Estero, 1 ♂, 1 ♀, [Paris Museum].

Troncal, Santiago del Estero, 1 ♀, [Paris Museum].

Icaño, Santiago del Estero, 1 ♂, 1 ♀, 1 juv. ♂, [Paris Museum].

Las Garzas, Rio Las Garzas, Santa Fé, Argentina, 2 ♀, [Paris Museum].

Carcaraña, Santa Fé, Argentina, 4 ♂, 1 ♀, [Hebard Cln.].

Comparison has been made with a specimen from Santa Cruz, Bolivia, in the Academy collection.

***Ischnoptera litostylata* new species. Plate XI, figures 7 and 8.**

This diminutive species would appear to be a paler and smaller type, related to *I. saussurei* and *I. icano* here described. Closer examination shows, however, that it belongs to a distinct phylum of

⁹⁶ Bearing label "*Blattella germanica*, ♀" and so recorded by Caudell, Jour. N. Y. Ent. Soc., XII, p. 183, (1904).

the small species of the genus, particularly distinctive in having the styles of the male subgenital plate simple, straight, cylindrical and virtually unarmed.

As we have elsewhere noted, a great number of small species of the genus exist, divisible by color features and pattern into only a few very large groups. The specialization of the male genitalia is distinctive in these species, often showing an astonishingly intricate development. Females are, however, exceedingly difficult to separate and should never be recorded as this or that species without the aid of some definite sex correlation.

Type: ♂; Las Garzas,⁹⁷ Rio Las Garzas, Santa Fé, Argentina. [Paris Museum.]

Size small, smaller than in *saussurei* or *icano*, form moderately slender. Interocular space very broad, slightly wider than that between the large ocelli, four-fifths as wide as that between the antennal sockets. Ocellar areas, maxillary palpi, few microscopic hairs of pronotum and tegmina, tegmina, wings and specialization of dorsal surface of abdomen as described for *icano* on page 276. Eighth tergite with caudal margin not as decidedly concave as in that species. Supra-anal plate nearly symmetrical, length approximately half basal width, surface very weakly convex in all but small latero-proximal portions, lateral margins straight and moderately convergent in brief portions to beyond cercal bases, thence less strongly convergent and feebly convex to distal portions, this portion broadly and weakly bilobate, the dextral slightly broader than the sinistral lobe, the median emargination thus formed broadly obtuse-angulate and rounded. Ventral surface of supra-anal plate with a small but heavy conical projection, slightly mesad of the base of the sinistral cercus; with a large, heavy tuft of agglutinated, chaetiform spines, which curve sinistrad, situated a brief distance before the base of the distal emargination, and with the dextral margin somewhat thickened ventro-proximad and armed with chaetiform spines. Paired plate beneath supra-anal plate large.⁹⁸ Subgenital plate rather decidedly convex laterad; sinistral margin nearly transverse to median production, a brief distance before that supplied with an elongate, slender, straight, cylindrical style, over four times as long as broad; dextral margin moderately oblique produced, broadly convex to median production, that area very small, about twice as broad as long, with margin broadly convex sinistrad to the rectangular, sharply rounded dextral angle, before which is situated the dextral style, slightly inset, but in every other way similar to the sinistral style.⁹⁹ These styles are virtually un-

⁹⁷ Twenty five kilometers west of Ocampo.

⁹⁸ In greater part hidden in the specimens at hand.

⁹⁹ In the paratype these styles average even longer, fully five times as long as broad.

armed, though one or two minute spines may be discerned dorad near their apices. Armament of limbs as characteristic of genus. Pulvilli, tarsal claws and arolia as described for *icano* on page 276.

Head auburn, shading ventrad to buffy, ocelli light buff. Antennae buffy proximad, shading rapidly to dresden brown. Palpi warm buff, with distal joint slightly darkened. Pronotum ochraceous-buff, weakly translucent cephalad and laterad, disk very faintly tinged with ochraceous-tawny except latero-caudad, where this becomes slightly heavier. Tegmina strongly translucent, ochraceous-buff, very faintly tinged with ochraceous-tawny, except in marginal field; veins not darkened. Wings transparent, even more weakly tinged with the same coloration, area of costal veins not darkened. Dorsal surface of abdomen buffy proximad, marbled with cinnamon-brown meso-distad, solidly cinnamon-brown distad. Cerci cinnamon-brown, becoming slightly paler distad. Limbs ochraceous-buff, the spines ochraceous-tawny. Ventral surface of abdomen cinnamon-brown.

The Paraguayan male is slightly darker, the pronotal suffusion slightly heavier and the proximal portions of the tegmina more strongly tinged with ochraceous-tawny.

Length of body¹⁰⁰ 9.3–9.5, length of pronotum 2.4–2.4, width of pronotum 3–3.1, length of tegmen 9–9.2, width of tegmen 2.9–3 mm.

In addition to the type, a paratypic male from Sapucay, Paraguay, collected in October, by W. T. Foster and belonging to the United States National Museum, has been studied.¹⁰¹

Ischnoptera saussurei¹⁰ new species. Plate XI, figures 9 and 10.

It is certain that Saussure's *Blatta fusca*, described in 1869,¹⁰³ represents this or a closely related species. That name is preoccupied by *Blatta fusca* Thunberg, 1784. As a result we here describe *saussurei* in full, the insect requiring a new name if not actually representing a new species.¹⁰⁴ The importance of the male genitalic development was not recognized at the time Saussure described *fusca* and it will, as a result, be necessary to examine the type before that name can be definitely placed.

The present species agrees closely with *I. icano* here described on

¹⁰⁰ The measurements of the type are given first.

¹⁰¹ This specimen was recorded as *Blattella germanica* by Caudell, Jour. N. Y. Ent. Soc. XII, p. 183. (1904).

¹⁰² In honor of that illustrious Orthopterist, Henri de Saussure.

¹⁰³ Rev. et Mag. de Zool., (2), XXI, p. 110. Described from Argentina, later given as Corrientes, Argentina.

¹⁰⁴ Rehn suggested that *fusca* might prove to be a synonym of *I. marginata* (Brunner) before the now large series of this section of the genus in the unstudied collections had been assembled. At that time it was supposed that the number of species, included in this section of the genus *Ischnoptera*, was much smaller than we now know to exist. Proc. Acad. Nat. Sci. Phila., 1915, p. 272, footnote 4.

page 276, differing signally only in the male genitalic specialization.

Type: ♂; Carcaraña, Santa Fé, Argentina. [Hebard Collection, Type no. 752.]

Size small, form moderately slender. Interocular space, ocellar areas, maxillary palpi, intercalated triangle of wings, dorsal surface of abdomen, titillator, armament of limbs, pulvilli, tarsal claws and arolia as described for *icano*. Latero-caudal sulci of pronotal disk moderately decided. Tegmina and wings fully developed, extending considerably beyond the cercal apices. Supra-anal plate symmetrical, two-fifths as long as basal width, brief lateral margins nearly straight and almost transverse to within cercal bases, the remaining produced portion symmetrically trapezoidal with angles broadly rounded, its surface broadly convex, weakly chitinous mesodistad, the latero-caudal angles thickened and well-supplied on their ventral surfaces with spiniform hairs directed cephalad, the dextral margin of this production mesad produced ventrad in a large, rounded lobe, its caudal margin also supplied with spiniform hairs directed meso-caudad. Within the anal chamber the socket of the sinistral cercus is produced mesad in a minute conical projection; adjacent to the dextral cercus the corresponding section is produced in a slender finger, which is directed mesad and then curves, with considerable angulation, ventrad, its apex armed with a few very minute spines. Paired plates beneath supra-anal plate developed into large lobes, the sinistral plate extending two-thirds the distance to the dextral cercus but more irregular and not as strongly or evenly swollen as in *icano*. Subgenital plate with surface supplied rather heavily with microscopic hairs, strongly convex, free margin thickened sinistro-proximad and lying just outside the sinistral cercal base, briefly inbent dextro-proximad beneath the dextral cercus, sinistral margin very broadly concave and showing very weak obliquity to the dextral style, which is situated a brief distance mesad of the cercus, dextral margin broadly convex to dextral style, where it forms an acute angulation, being very briefly directed caudad to base of the style. Dextral style heavy, curving sinistrad from its thickened base, two and one-half times as long as its basal width, tapering to its blunt apex, with entire dorsal surface thickly supplied with minute spines. Sinistral style on sinistral margin a distance equal to its basal width from dextral style, tapering and curved weakly dextrad beyond its slightly thickened base, only slightly shorter but decidedly less heavy than dextral style and unarmed.¹⁰⁵

Allotype: ♀; same data as type. [Hebard Collection.]

Agrees closely with male in all ambisexual characters, differing in the following respects. Head slightly broader, the interocular

¹⁰⁵ Compared with *icano*, the marginal contour of the subgenital plate at the styles and their general structure is found to be very similar. In *saussurei* the styles are appreciably heavier.

space four-fifths as wide as that between the slightly less prominent ocelli, but fully two-thirds that between the antennal sockets. Supra-anal plate half as long as distance between cercal bases, produced and nearly semicircular between these, subchitinous in distal portions. Subgenital plate short, rather decidedly convex, free margin broadly and nearly evenly convex.

Coloration as described for *icano*. The male type has the medio-longitudinal paler streak of the pronotum even more suffused, while the allotype has this marking nearly obliterated. In the male type the coxae are less darkened and the tegmina are more evenly suffused, while in the female allotype the coloration is darker. These features are due to intensification and recession in coloration and it would appear that in color features *saussurei* and *icano* are similar.

Length of body ♂ 10.2, ♀ 11¹⁰⁶–10.7; length of pronotum ♂ 2.7, ♀ 3.1–2.9; width of pronotum ♂ 3.6, ♀ 4–3.8; length of tegmen ♂ 12, ♀ 12.3–11.8; width of tegmen ♂ 3.7, ♀ 3.9–3.7 mm.

In addition to the type and allotype, a paratype female, bearing the same data, is before us.

Ischnoptera *icano* new species. Plate XI, figures 11, 12 and 13.

This species is very closely related to *I. saussurei* here described, showing, however, distinctive features in the male genitalia.

Of the small brown species of the genus, with pronotum margined laterad and cephalad with buffy, five distinct species are before us from the Argentine and Paraguay. Recent studies have shown that an enormous number of forms belonging to this section of the genus occur in tropical and subtropical America, frequently separable on male genitalic characters alone, these parts, however, often showing an intricacy of specialization of astounding degree.

Type: ♂; Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. [Paris Museum.]

Size small, form moderately slender. Interocular space moderately broad, four-fifths as wide as that between the large ocelli, nearly half that between the antennal sockets. Flattened surfaces of ocellar areas forming a rather blunt angle with the interocellar area. Maxillary palpi short, fifth joint very slightly longer than third, the fourth two-thirds as long as the third joint. Latero-caudal sulci of pronotal disk very decided. Microscopic hairs scattered over lateral portions of pronotum and proximal portions of tegmina. Tegmina and wings fully developed, extending a short distance beyond apices of cerci. Wings with a moderately well-developed intercalated triangle. Dorsal surface of abdomen specialized as is characteristic of the genus, eighth tergite with caudal margin

¹⁰⁶ The measurements of the allotype are here given first.

rather strongly concave. Supra-anal plate nearly symmetrical, slightly over half as long as basal width, brief lateral margins weakly convex and almost transverse to median produced portion; this portion strongly convex, the convexity extending to the base of the plate, the free lateral margins consequently curled downward, rounding distad into the transverse, subchitinous distal margin, this portion as long as its basal width, tapering evenly and gently distad where it is supplied with a few, elongate, scattered hairs; ventral surface unspecialized but furnished thickly at the disto-lateral rounded angles of the produced portion with minute spiniform hairs, these slightly the heavier on the dextral side and there extending to the base of the produced portion. Within the anal chamber, adjacent to the sinistral cercus, the socket is developed in a minute rounded lip without production, adjacent to the dextral cercus the corresponding section is produced in a triangular projection, twice as long as its basal width, the caudal surface of which is very deeply concave. Paired plates beneath supra-anal plate developed into large lobes, apparently unarmed; the sinistral plate expanding mesad into a very large rounded lobe, which extends two-thirds the distance to the dextral cercus. Titillator with apex simple, aciculate. Subgenital plate strongly convex, with surface supplied rather heavily with microscopic hairs, lateral margins consequently dorsal in position, straight produced, then curving broadly ventrad, so that the margin beyond in dorsal aspect is transverse; internal surface toward free margins and styles as hairy as external surface. Sinistral style a stout, straight, cylindrical process, tapering, slightly shorter than dextral style. Dextral style heavier, springing from a minute offset of the margin, curved weakly sinistrad with a weak median angulation, proximal half stout and slightly tapering, distal half more strongly tapering to the apex, which, like the dorsal portion of the distal half, is armed with minute spines. Armament of limbs as characteristic of the genus. Four proximal tarsal joints supplied ventro-distad with small but readily observed pulvilli. Moderately well developed arolia present between the bases of the slender, simple, symmetrical tarsal claws.

Head auburn, shading to buffy on mouthparts; ocelli warm buff. Antennae buffy proximad, shading rapidly to dresden brown. Distal joint of palpi prouts brown. Pronotum shining, auburn, with a medio-longitudinal suffused tawny line and cephalic and lateral margins narrowly translucent buffy, caudal margin tawny, these paler marginal portion not sharply defined. Tegmina translucent, light chestnut brown with costal field dark chestnut brown in inner half and warm buff in half toward costal margin, costal veins distinctly darker than intervening areas. Wings very weakly suffused with brown, area of costal veins darker, particularly the veins themselves. Dorsal surface of abdomen buffy proximad, the greater portion laterad and distad chestnut brown. Cerci chestnut brown.

Cephalic coxae proximad and proximal half of median and caudal coxae blackish chestnut brown, remaining portions of limbs buffy with spines tawny. Ventral surface of abdomen chestnut brown, shading to ochraceous-tawny meso-proximad.

It is to be noted that the coloration of *I. panamae* Hebard, *I. tolteca* Saussure and *I. nana* Saussure and Zehntner, shows close agreement to that of this species.

Length of body 11.2, length of pronotum 2.7, width of pronotum 3.4, length of tegmen 11.1, width of tegmen 3.3, length of cercus 2.2, length of caudal femur 3.8, length of caudal metatarsus 1.9, length of succeeding caudal tarsal joints 1.8 mm.

In addition to the type, two paratype males are before us from La Palisa del Bracho, Laguna Mamaita, Santiago del Estero, Argentina.

***Pseudomops neglecta* Shelford.**

1906. *P[sseudomops] neglecta* Shelford, Trans. Ent. Soc. London, 1906, p. 256. [♀; Rio Grande do Sul, Brazil.]

Villa Lutecia, near San Ignacio, Misiones, Argentina, 1 ♂.

Gran Chaco, Argentina, 1 ♂.

Icaño, Rio Salado, Santiago del Estero, Argentina, 1 ♂, 2 ♀.

Averias, Rio Salado, Santiago del Estero, Argentina, 1 ♀.

Las Garzas, Rio Las Garzas, Santa Fé, Argentina, 1 ♂, 3 ♀.

NYCTIBORINAE.

***Pseudischnoptera rhabdota*¹⁰⁷ new species. Plate XI, figures 15, 16 and 17.**

This handsome insect is structurally very similar to *P. lineata* (Olivier); differing only in the narrower interocular space, the very broadly and weakly convex pronotal disk, which is flat in that species, and specialization of the meso-distal portion of the male supra-anal plate. The coloration and color-pattern of tegmina and wings is very distinctive in this insect, however, and very different from the striking type shown by *lineata*.

Type: ♂; Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. [Paris Museum.]

Size small, form relatively slender for the subfamily. Head elongate, flattened; eyes not extending ventrad of the antennal sockets laterad; inter-ocular space moderately broad, two-fifths as wide as that between the antennal sockets; ocellar spots small but distinct. Maxillary palpi short, third joint as long as the decidedly expanded fifth joint; fourth very slightly over half as long, expanding strongly distad, with dorsal surface suddenly minutely impressed at the dis-

¹⁰⁷ From $\dot{\rho}z\beta\dot{z}\omega\tau\dot{\eta}$ =streaked.

tal margin. Pronotum with disk broadly and very weakly convex, the comparatively narrow lateral portions weakly declivent; pronotum triangular in shape with angles broadly rounded; the lateral margins diverging from the head to the latero-caudal angles, these and the transverse caudal margin nearly straight, very feebly convex; greatest width at latero-caudal angles. Tegmina and wings fully developed, extending well beyond cercal apices, narrower but showing similar venation to those of the species of *Nyctibora*. Dorsal surface of abdomen with median segment showing transverse median depression, formed by the fusion of two circular depressions, this depression partially filled with a pale substance which, in drying, has become hard, like shellac. Fourth, sixth, and eighth tergites, with latero-caudal angles alone produced and rounded. Supra-anal plate bluntly triangularly produced, median portion depressed, this area forming a distal longitudinal subchitinous area terminated distad as the broadly convex apex of the plate, the chitinous portion on each side terminating in a large, stout, straight, elongate spine, directed caudad.¹⁰⁸ Subgenital plate deplanate, with lateral portions narrowly bent dorsad as far as insertion of styles, the lateral portions straight in ventral aspect and moderately convergent to the broad and very weakly convex apex; sinistral style proximad, springing from a point beneath base of sinistral cercus, straight, cylindrical, tapering to its rounded apex and slightly over three times as long as its basal width, lying along margin of plate; dextral style springing from dextro-distal angle, similar, but only half as large and only slightly over twice as long as its basal width, likewise lying along margin of plate. Cephalic femora armed in distal third of cephalic margin with (five to ten in the series) small, stout spines, terminating in three large spines, more elongate in increasing ratio distad; ventro-caudal margin armed in corresponding portion with (three or four) heavy, elongate spines. Ventro-cephalic margins of other femora armed only distad with (one to five in the series) small, stout, irregular spines; ventro-caudal margins well-supplied with stout and elongate spines. Caudal metatarsus unarmed; four proximal tarsal joints supplied with large pulvilli. Large chitinous arolia present between the nearly symmetrical, simple tarsal claws. Important features of coloration given below.

Allotype: ♀; same data as type. [Paris Museum.]

Agrees closely with male except in the following characters. Eyes smaller, but with interocular space no wider. Pronotum broader, with lateral margins slightly more convex. Tegmina and wings reduced, reaching meso-distal portion of abdomen. Abdomen with dorsal surface unspecialized. Supra-anal plate hairy, half as long as width between cerci, produced between these, the

¹⁰⁸ These spines similar to those found in *lineata*, but with depressed and subchitinous intervening area distinctive.

margins there broadly convex-convergent to a small distal emargination. Subgenital plate large, convex; margins below cerci concave, broadly convex between these points.

Coloration of sexes similar. Entire insect shining blackish brown, except as follows. Eyes tawny olive, ocellar spots buffy. Antennae and limbs paling to chestnut brown distad. Pronotum margined cephalad and laterad with a band of warm buff, this band narrowest cephalad, the immediate lateral margins narrowly blackish brown. Tegmina translucent except in darker portions; marginal field warm buff, the cingulate margin blackish brown paling to ochraceous-tawny distad; humeral trunk suffused with blackish brown in proximal two-thirds, remaining portions ochraceous-tawny with interval between costal veins and veins of anal and proximal portion of discoidal field buffy. Frequent individuals are more strongly ferruginous in area between the humeral trunk and sutural margin of the tegmina. Wings transparent, anterior field tinged with ochraceous-tawny, the veins and entire area of costal veins of this color; radiate field weakly tinged with ochraceous-tawny.

MEASUREMENTS (*in millimeters*).

	♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
Icaño, Argentina, <i>type</i>		20.5	4.9	6.7	19	6
Icaño, Argentina, <i>paratypes</i> (4)		19.3-22	4.3-4.8	6.2-6.8	18-19.6	6-6.3
Barrancas, Argentina		17.8	4.8	6.6	18.7	6.2
	♀					
Icaño, Argentina, <i>allotype</i>		19.2	5	6.8	12.2	5.1
Icaño, Argentina, <i>paratype</i>		17	4.8	6.7	11.8	5.7
Barrancas, Argentina (3)		19.8-20	4.7-5.3	6.5-7	12.7-13.1	5.1-5.8
Troncal, Argentina		18.8	4.8	6.8	12.2	5.2

It is of interest to note that, though the adults of this species do not show the microscopic prostrate hairy covering usual in Nyctiborids, that condition is shown, though not strongly, in the immature stage. The immature individual before us has the pronotum marked as in the adults, the mesonotum and metanotum bordered laterad more broadly with buffy, each of these areas crossed by a band of blackish brown, the four larger abdominal tergites with an elongate, narrow, longitudinal marking on each side of buffy, the immediate lateral margins being dark.

Specimens Examined: 14; 7 males, 6 females and 1 immature individual.

Border of Rio Salado, near Icaño, Santiago del Estero, Argentina, 2 ♂, 2 ♀, *type*, *allotype*, *paratypes*, 1 juv.

Guarda Escolta, near Icaño, Santiago del Estero, Argentina, 4 ♂.

Barrancas, Banados del Rio Dulce, Santiago del Estero, Argentina, 1 ♂, 3 ♀.

Troncal, Santiago del Estero, Argentina, 1 ♀.

Nyctibora sericea Burmeister.

1838. *Nyctibora sericea* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 501. [Brazil.]

Villa Lutecia, near San Ignacio, Misiones, Argentina, 1 ♀.

The confusion which has existed, concerning the proper name to be used for this species, is pointed out on page 239.

Nyctibora glabra Giglio-Tos.

1897. *N[nyctibora] glabra* Giglio-Tos, Boll. Mus. Zool. Anat. comp. Univ. Torino, XII, No. 302, p. 9. [♂, ♀; San Francisco and Caiza, Ecuador.]

Gran Chaco, Argentina, 1 ♂, 1 juv.

Icaño, Santiago del Estero, Argentina, 1 ♂, 2 ♀.

Rio Salado, near Icaño, Santiago del Estero, Argentina, 2 ♀.

Guarda Escolta, near Icaño, Santiago del Estero, Argentina, 13 ♂, 3 ♀, 11 juv.

Barrancas, Santiago del Estero, Argentina, 2 ♀.

Cruz del Eje, Cordoba, Argentina, 3 juv., [Hebard Cln.].

The size variation, shown by the males from Guarda Escolta, is as follows; length of body 22-27.5, length of pronotum 5.3-6.4, width of pronotum 7.7-9, length of tegmen 23.8-29, width of tegmen 7.8-9 mm.

EPILAMPRINAE.

Epilampra cinerascens Brunner.

1865. *Epilampra cinerascens* Brunner, Nouv. Syst. Blatt., p. 173. [♂ Brazil.]

Villa Lutecia, near San Ignacio, Misiones, Argentina, 1 ♀, [Hebard Cln.]

The wing coloration is a distinctive feature in the present species. The anterior field is rather strongly suffused with ochraceous-tawny, slightly darkened in proximal two-thirds and particularly in area of costal veins and with a few dark points on the margin distad; the radiate field is weakly suffused with mummy brown, except for a border around the peripheral margin which is weakly suffused with ochraceous-tawny, this border widening toward the anterior field.

Length of body 21, length of pronotum 5.1, width of pronotum 6.7, length of tegmen 17.9, width of tegmen 5.9, length of caudal femur 6.9 mm.

Epilampra heusseriana Saussure.

1864. *Epilampra heusseriana* Saussure, Rev. et Mag. de Zool., (2), XVI, V, p. 321. [♀, Uruguay.]

Montevideo, Uruguay, 1 ♂, 1 ♀, [Hebard Cln.].

This species has been assigned to the genera *Calolampra* and *Audreia*, due mainly to the fact that the type female had short truncate tegmina. Though this is true for the female sex, the male before us is seen to have fully developed organs of flight, and shows no characters which would warrant its being placed other than in the genus *Epilampra*. The sexual diversity here shown is seen to be in a way intermediate between that found in *E. jorgenseni* (Rehn)¹⁰⁹ and the usual condition in the genus in which the sexes agree closely.

The female before us agrees closely with Saussure's figure,¹¹⁰ except in being more reddish, the ground coloration of pronotum and tegmina being ochraceous-buff, tinged with ochraceous-tawny.

The male shows the correctness of the sex association particularly in many of the delicate features of color-pattern. As it had not been previously recognized, we give the following data as to the coloration of this sex.

Head light ochraceous-buff, occiput with four irregular, vertical, linear suffusions of blackish brown, below these a patch as long as wide, of blackish brown.¹¹¹ Antennae ochraceous-buff. Pronotum light ochraceous-buff, with very many microscopic dots of prouts brown, numerous larger though minute dots and a delicate, interrupted lyrate discal pattern of blackish brown. Tegmina transparent light ochraceous-buff, with numerous minute dots (which become smaller distad) and a few flecks of blackish brown, humeral trunk blackish brown to nearly opposite apex of anal field. Limbs light ochraceous-buff; femora margined dorsad with blackish brown, a narrow medio-longitudinal weak suffusion on the cephalic face, both faces with a heavy blackish brown suffusion disto-ventrad; tibiae dark brown in entire ventral half; distal portions of tarsal joints suffused with dark brown.

In the female the abdomen has the caudal margins of the tergites regularly marked with small longitudinal patches of blackish brown, which do not project.¹¹²

Length of body ♂ 20, ♀ 21.7; length of pronotum ♂ 5.7, ♀ 6.1; length of tegmen ♂ 24, ♀ 7.1¹¹³; width of tegmen ♂ 6, ♀ 5.5;

¹⁰⁹ See page 283, footnote 115.

¹¹⁰ Mém. l'Hist. Nat. Mex., III, pl. II, fig. 24.

¹¹¹ In the female this patch is more extensive, fusing with the occipital lines dorsad.

¹¹² Saussure describes these as "saillies", this may be in error, as our specimens agrees with the description very closely in all other respects. Many species of the genus have longitudinal projections in place of the markings shown by the example before us.

¹¹³ Exposed length, 6 mm.

length of caudal femur ♂ 7.8, ♀ 6.8; length of caudal metatarsus ♂ 3.2, ♀ 3 mm.

The female recorded by Rehn from Pará, Brazil, as this insect, represents a distinct species, having in that sex transversely truncate tegmina and immaculate tibiae.

Epilampra berlandi¹¹⁴ new species. Plate XII, figures 1 and 2.

This handsome little insect is one of the smaller species of the genus, showing in the male sex affinity to the larger, but in general similarly colored, males of *E. jorgenseni* (Rehn).¹¹⁵ Compared with the male of that species, the present males are found to differ in the decidedly smaller size, wider interocular space, less produced caudal portion of pronotum, less diaphanous tegmina, with much more numerous and smaller maculations and darker wings, with area of costal veins opaque and very dark. Considering the affinity to *jorgenseni*, we believe that the female of this species will also be found to differ very greatly from the male.

The size, rather depressed form, grayish coloration and shape and marking of the tegmina give the species a much closer superficial resemblance to certain North American species of the Polyphagid genus *Arenivaga* than is shown by any of the other known species of *Epilampra*.

Type: ♂; Icaño, Santiago del Estero, Argentina. December. [Paris Museum.]

Size rather small, form depressed for the genus. Head very slightly projecting beyond the pronotum, considerably depressed; interocular space nearly twice the occipital ocular depth; ocelli very large. Pronotum of the type characteristic for the genus, the surface more flattened and production caudad weaker than is usual, agreeing closely with that of *jorgenseni* except in these respects. Tegmina extending beyond apex of abdomen slightly more than pronotal length, moderately broad, the median half subequal in

¹¹⁴ Named in honor of Monsieur Lucien Berland, of the Paris Museum, through whose kind coöperation the present collections have been put in our hands for study.

¹¹⁵ A detailed comparison of the type of *Rhicnoda jorgenseni* Rehn, a female, (described from the Misiones, Argentina, Proc. Acad. Nat. Sci. Phila., 1913, p. 277, fig. 1) and males, including the type of *Epilampra stigmatiphora* Rehn, (described from the Misiones, Argentina, Proc. Acad. Nat. Sci. Phila., 1913, p. 279, fig. 2) convinces us that but a single species is represented, of which the sexes are widely dissimilar. The males show no features which would warrant generic separation from the other species of *Epilampra*. The female, however, is a patelliform type, evidently retaining in the adult numerous features characteristic of the early stages and having tegmina alone represented by small, lateral, triangular pads. As a result the species is recognized as *Epilampra jorgenseni* (Rehn), the first species of the genus known to show wide dissimilarity in the sexes.

width; distal margin arcuate oblique from sutural margin to the well rounded apex, which is situated nearer the costal margin; anal field very elongate pyriform. Wings ample; area of costal veins rather broad, opaque; ulnar vein with (seven) incomplete and (two) complete branches. Abdomen strongly depressed. Supra-anal plate bilobate, with apices rather sharply rounded, length two-thirds distance between cerci. Cerci small, tapering distad, with apical portion very slender. Subgenital plate as characteristic of genus; moderately asymmetrical, lobate; styles very small, straight, simple. Armament of limbs (except that, as in *jorgenseni*, the ventrocephalic margin of the cephalic femora is armed with one, instead of the usual two, heavy distal spines), pulvilli and arolia as characteristic of *Epilampra*.

Head cream color, the occiput obscurely striate vertically with buffy, with a broad interocular band of blackish mummy brown, which sends a ray ventrad along the ventral margin of each ocellus. Eyes mummy brown. Underparts warm buff, limbs light ochraceous-buff. Pronotum cream color, rather thickly and very minutely dotted with mummy brown, these dots enlarging slightly mesad and forming minute longitudinal maculae on the margin of the caudal production, the disk further marked with minute flecks of prouts brown. All of the pronotal markings are so small that it appears merely more strongly suffused mesad, without noticeable picturing, the sublyrate median pattern being even more obscure than in *jorgenseni*. Tegmina with marginal field opaque, cream color, with very few punctae of mummy brown; other portions translucent, tinged with saccardos umber and thickly flecked with mummy brown, with a few larger flecks meso-distad; humeral trunk to near end of marginal field heavily suffused with mummy brown. Area of dextral tegmen, concealed when at rest, bister, flecked only in its inner portion. Wings with area of costal veins opaque, bister with immediate margin slightly paler, beyond this with a few marginal flecks of bister; other portions transparent, tinged with bistre, the veins bister. Dorsal surface of abdomen clay color, shading to bister distad.

Length of body¹¹⁶ 15.7–15.7, length of pronotum 4.3–4.4, width of pronotum 5.6–5.8, length of tegmen 15.9–16, width of tegmen 5.6–5.6 mm.

In addition to the type, a single paratypic male bearing the same data, two immature males and one immature female from Cruz del Eje, Cordoba, Argentina, in the Hebard Collection, are before us.

¹¹⁶ The type measurements are given first.

BLATTINAE.

Blatta orientalis Linnaeus.

1758. [*Blatta*] *orientalis* Linnaeus, Syst. Nat., Ed. X, I, p. 424. [America; the East; Russia; Stockholm, Sweden; Finland.]

Tucuman, Tucuman, Argentina, 1 ♂, [Hebard Cln.].

Buenos Aires, Buenos Aires, Argentina, 2 ♀, [Hebard Cln.].

Periplaneta brunnea Burmeister.

1838. *P[eriplaneta] brunnea* Burmeister, Handb. Ent., II, Abth. II, Pt. I, p. 503. [♂, ♀; Chile; Demerara (= British Guiana).]

Las Garzas, Rio Las Garzas, Santa Fé, Argentina, 1 ♀.

PANCHLORINAE

Panchlora thalassina Saussure and Zehntner.

1893. *Panchlora thalassina* Saussure and Zehntner, Biol. Cent.-Am., Orth., I, p. 93. [♂, ♀; Guatemala; Santa Catharina, Brazil; La Plata, Argentina.¹¹⁷]

Villa Lutecia, near San Ignacio, Misiones, Argentina, January to April, 1 ♂, 2 ♀.

Bella Vista, Rio Parana, Corrientes, Argentina, 1 ♀.

Colonia Florencia, Rio Tapenaga, Chaco, Argentina, 1 ♂.

Barrancas, Banados del Rio Dulce, Santiago del Estero, Argentina, 1 ♀.

Troncal, Santiago del Estero, Argentina, 1 ♀, 1 juv. ♀.

Las Garzas, Rio Las Garzas, Santa Fé, Argentina, 1 ♀.

Tribonium guttulosum (Walker)

1868. *Nauphoeta guttulosa* Walker, Cat. Blatt, Br. Mus., p. 184. [♂, Brazil.]

Villa Lutecia, near San Ignacio, Misiones, Argentina, 1 ♀.

This species appears to be extremely close to *T. conspurcatum* (Burmeister). From Brunner's detailed description of that species, it would appear to differ in the unicolorous black antennae, and in pronotum, the proportions of which are given as 4 by 5.6 millimeters.

Length of body 19, length of pronotum 4, width of pronotum 7.1, length of tegmen 15, width of tegmen 5.6 mm.

Tribonium spectrum (Eschscholtz)

1822. *Blatta spectrum* Eschscholtz, Entomographien, p. 85. [Santa Catharina, Brazil.]

¹¹⁷ We here select La Plata, Argentina, as the type locality of this species. It is closely related to *P. cubensis* Saussure and, in the very large series of the genus before us, is recognizable only from material from Paraguay and northern Argentina. The Santa Catharina record may, therefore, represent the same species, but we are confident that that from Guatemala is based on either a misidentification or material incorrectly labelled.

Villa Lutecia, near San Ignacio, Misiones, Argentina, 1 ♂.

On page 242 of the present paper we have compared *T. conspersum* (Guérin and Percheron) with the present species.

BLABERINAE.

Blaptica interior new species. Plate XIV, figure 1.

This species is very closely related to *B. dubia* (Serville), differing in the male sex in the more slender form, in the strikingly smaller pronotum, with lateral portions of cephalic margins not weakly reflexed and lateral margins broadly rounded, showing hardly a trace of the angulation distinctly developed (though to varying degrees) in *dubia*, and in the narrower interocular space. In addition the ventral surface is paler, that surface with subgenital plate and sometimes the preceding segment alone solidly dark, while the dark marking of the pronotal disk is truncate cephalad, ceasing abruptly before the convex section above the head.

Females of these species are very similar, those of *interior* being less robust, with interval between the tegmina decidedly less.

Type: ♂; Cordoba, Cordoba, Argentina. [Hebard Collection, Type no. 672.]

Size rather small for the genus, very small for the Blaberinae; form slender for the genus. Interocular space narrower than in *dubia*, one-third (varying in the series to two-fifths) as wide as the interocellar space. Ocelli large and prominent, each with a circular and similarly subchitinous spot of about half the size immediately ventrad. Maxillary palpi with distal joint very slightly longer than fourth. Pronotum with impressed lyrate pattern of disk and convex area above head as in *dubia*, but differing decidedly in the almost perfectly oval outline, without lateral angles and weakly cingulate, but not moderately reflexed, lateral portions of the cephalic margin. Tegmina elongate and narrow, with margins parallel for a considerable distance; anal field ample and elongate, as in *dubia*. Supra-anal plate broadly truncate, bilobate. Subgenital plate forming an asymmetrical lobe, with two very small, simple styles. Ventro-cephalic margin of cephalic femora supplied with a row of closely placed, moderately elongate, spiniform hairs, terminating in a single large distal spine.¹¹⁸ Other ventral femoral margins (excepting in many paratypes the entirely unarmed ventro-caudal of the caudal femora, and in this the normal condition in the species) armed with a single large distal spine, the ventro-caudal

¹¹⁸ This condition is also found in *dubia*, but in that species frequent specimens have one or more short, heavy, proximal spines and two heavy spines distad on the ventro-cephalic margin of the cephalic femur. Variation in that species is decided, as will possibly be found to be true for *interior* also.

margins of the median and caudal femora supplied with elongate hairs. Four proximal tarsal joints with large pulvilli,¹¹⁹ that of the metatarsus linear in large portion, running to the base; last (fifth) joint with ventral surface subchitinous in a longitudinal, linear area. Tarsal claws heavy, symmetrical, simple; arolium suggested by a very minute chitinous convexity between their bases.

Allotype: ♀; Cruz del Eje, Cordoba, Argentina. [Hebard Collection.]

Very different in general appearance from male. Size larger, form broader. Interocular space narrower than in *dubia*, though much broader than in male, slightly narrower than that between the somewhat less prominent ocelli. Pronotum larger, rather strongly convex to the cingulate lateral margins, which mesocephalad are weakly and narrowly reflexed; margin nearly semi-circular to the truncate caudal margin, the latter showing a sub-obsolete convexity between the shoulders; latero-caudal angles rectangulate and sharply rounded. Tegmina greatly reduced, extending caudad as far as (varying in the series to slightly beyond) caudal margin of median segment, oblique truncate from bluntly rounded apex to near base of sutural margin (often with section in anal field less oblique and showing some convexity); unlike females of *dubia*, separated by a very brief interval (varying to attaining in the series). Abdomen much larger and heavier in structure. Cerci moniliform, very small, projecting only slightly beyond the abdominal outline. Limbs and their armament and specialization similar to male, except that they are somewhat shorter and heavier.

Coloration of male. Head blackish liver brown, the ocelli and subocellar areas, proximal antennal joint, palpi and mouth-parts ochraceous-buff. Pronotum translucent ochraceous-buff; disk blackish prouts brown with flecks of ochraceous-buff mesad,¹²⁰ this dark area spreading and including the shoulders and intervening area caudad, becoming deep cinnamon-brown latero-caudad. Tegmina ochraceous-buff in proximal portion of anal field, all of marginal field and more narrowly distad on costal margin, humeral trunk heavily suffused with blackish chestnut brown, this spreading over all portions of the tegmina except those mentioned above, but becoming dilute toward the sutural margin and distad. In one paratype the entire anal field is pale, while in another the dark suffusion is very weak everywhere except toward the humeral trunk. Wings transparent, tinged with dresden brown in anterior field, but opaque, buffy, in area of costal veins, faintly tinged with brown

¹¹⁹ This and the following features we believe to be of generic rather than specific value.

¹²⁰ In the series of paratypes there are individuals with disk lacking pale flecks or showing one or two lateral linear flecks and a single mesal or meso-caudal fleck. In the type there is an additional fleck mesad, while in other paratypes there is a distinct lyrate area of this paler coloration. Intensification and recession of color pattern account for these differences.

in radiate field, veins prouts brown. Dorsal surface of abdomen weakly mottled tawny olive, laterad rather broadly margined on each side with pinkish buff. Underparts and limbs ochraceous-buff, spines blackish becoming russet proximad. Ventral surface of abdomen with each segment flecked laterad with blackish prouts brown, the subgenital plate and meso-caudal portion of preceding sternite entirely of this color, the preceding sternites washed weakly laterad and in an obscure transverse median band with prouts brown.

In the females the coloration is generally similar, the exposed dorsal surface of the abdomen ochraceous-buff, often tinged with tawny, each segment heavily marked with blackish brown except laterad and caudad, frequently with patches mesad on each side and along the median line of the paler coloration, so that in such examples the abdomen shows five distinct longitudinal, pale, interrupted bands.

For purposes of comparison the measurements, in millimeters, for *interior* and *dubia* are given in the following table.

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
<i>Blaptica interior</i>					
Gran Chaco, Argentina	30	8.1	11.6	32.8	10
Averias, Argentina	29.8	7.7	10.1	30.7	9.8
Icaño, Argentina	31	8	11.2	34.3	9.7
Icaño, Argentina	30.2	8	11.2	31.7	10
Icaño, Argentina	28	8	11.7	29.7	9.8
Guarda Escolta, Argentina	28.4	8	11.1	30.8	9.8
Cruz del Eje, Argentina, <i>paratype</i>	30	8.2	11.4	32.3	10.3
Cruz del Eje, Argentina, <i>paratype</i>	33.5	8.2	11.3	32.2	9.8
Cordoba, Argentina, <i>type</i>	30	8	11.6	33.5	10.9
<i>Blaptica dubia</i>					
Rosario, Argentina	32.3	9	13	32.5	10.9
Carcaraña, Argentina	32.7	9.9	13.1	33	11.6
San Nicolas, Argentina	28.5	9	11.8 ¹²¹	32.5	11.2
San Nicolas, Argentina	34	9.4	13.1	34.2	10.9
San Nicolas, Argentina	31	9.6	13	33.9	11.2
Buenos Aires, Argentina	31	9.1	12.1	33	11.8
Buenos Aires, Argentina	30	9.9	13.5	34.5	11.5
Cordoba, Argentina	35.5	9.1	12.9	32	11
Cordoba, Argentina	34.8	9.7	12.8	32	12

¹²¹ The pronotum is strongly asymmetrical in this specimen, one side being imperfectly developed.

♀	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen	Width of interval between tegmina
<i>Blaptica interior</i>						
Icaño, Argentina	32.3	9.7	13.8	8.7	8.9	.8
Troncal, Argentina	32.7	9.7	13.8	8.7	8.7	.3
Guarda Escolta, Argentina	26.2	8.7	12.7	7.1	7.3	.8
Guarda Escolta, Argentina	30.8	9.2	13.2	7.4	8	.9
Guarda Escolta, Argentina	30.8	9.4	13.7	8.2	8.9	0
Cruz del Eje, Ar- gentina, <i>paratype</i>	29.6	9	13.6	8.3	8	1.3
Cruz del Eje, Ar- gentina, <i>paratype</i>	30	9.4	13.4	8.9	9	0
Cruz del Eje, Ar- gentina, <i>allotype</i>	33.4	10	13.7	9	8.8	.8
<i>Blaptica dubia</i>						
Montevideo, Uru- guay	33	10.3	14.9	9.2	7.7	4.2
Montevideo, Uru- guay	35.4	10.7	15.8	8.7	7.4	5.5
Carcaraña, Argen- tina	33.5	9.6	14.3	9	7.4	4
Buenos Aires, Ar- gentina	31.9	9.8	14.2	8.2	7	3.7
Buenos Aires, Ar- gentina	31	10.3	15.2	9	7.9	3.9

Specimens Examined: 55; 15 males, 35 females and 5 immature individuals.

Gran Chaco, Argentina, 1 ♂.

Chaco Santa Festino, Argentina, August to October, 1911, (W. H. Schladitz), 1 ♀. [Hebard Cln.].

Icaño, Rio Salado, Santiago del Estero, Argentina, 4 ♂, 3 ♀.

Averias, Rio Salado, Santiago del Estero, Argentina, December, 1 ♂, 1 juv. ♂.

Paso de Don José, Rio Salado, Santiago del Estero, Argentina, 2 ♀.

Troncal, Santiago del Estero, Argentina, 1 ♀, 1 juv. ♂.

La Palisa del Bracho, Rio Salado, Santiago del Estero, Argentina, December, 4 ♂, 1 ♀.

Guarda Escolta, Rio Salado, Santiago del Estero, Argentina, 1 ♂, 14 ♀. 1 juv. ♀.

Cruz del Eje, Cordoba, Argentina, 2 ♂, 13 ♀, *allotype*, *paratypes*, 2 juv., 3 oothecae, [Hebard Cln., A. N. S. P., and U. S. N. M.].

Cordoba, Cordoba, Argentina, 1 ♂, *type*.

Buenos Aires, Buenos Aires, Argentina, 1911, (Dr. C. C. Craft; on ship), 1 ♂, [U. S. N. M.].

Blaptica dubia (Serville) Plate XIV, figure 2.

1839. *Blabera dubia* Serville, Hist. Nat. Ins. Orth., p. 78. [♂, Brazil; Buenos Aires, Argentina.]

Montevideo, Uruguay, 2 ♀

Rosario, Santa Fé, Argentina, 2 ♂, 1 ootheca, [A. N. S. P. and Hebard Cln.].

Carcaraña, Santa Fé, Argentina, 1 ♂, 1 ♀, [Hebard Cln.].

San Nicolas, Buenos Aires, Argentina, 3 ♂, [Hebard Cln.].

Buenos Aires, Buenos Aires, Argentina, 2 ♂, 1 ♀, 2 juv., [Paris Museum, A. N. S. P. and Hebard Cln.].

Cordoba, Cordoba, Argentina, 2 ♂, [Hebard Cln.].

The series shows no very decided intensification or recession of color pattern. The paler individuals, however, do not have the pronotal maculation solidly dark; in some, paired buffy flecks occur, in occasional females the face-like marking, developed in certain species of *Blaberus* is shown, while in some males a blurred lyrate pattern is developed.

Blaberus fraternus Saussure.

1864. *Blabera fraterna* Saussure Mém. l'Hist. Nat. Mex., III, p. 241. [♂; South America, (The Antilles, Cuba?).]

Gran Chaco, Argentina, 2 ♂.

Colonia Florencia, Rio Tapenaga, Chaco, Argéntina, 1 ♂, 1 ♀.

Chaco Austral, north of Icaño, Santiago del Estero, Argentina, 2 ♂.

Icaño, Santiago del Estero, Argentina, 4 ♂, 3 ♀.

Rio Salado, near Icaño, Santiago del Estero, Argentina, 2 ♂, 1 ♀.

La Palisa del Bracho, Rio Salado, Santiago del Estero, Argentina, December, 1 ♂.

The species has previously been recorded from Argentina only from Jujuy, in the province of the same name.

Considerable color variation is shown by the series. In one male and the three females, the dark pronotal marking spreads caudad, covering the shoulders; in but one of these specimens do pale points show mesad in this dark area. In the males the most recessive specimen shows a short medio-longitudinal pale streak and latero-caudad of it two large oblique flecks of the same color in this area. In one male with perfectly shield-shaped pronotal marking, this area is solidly dark. In all, the dark pronotal area is terminated by the caudal margin of the pronotum.

Eublaberus argentinus new species. Plate XIV, figure 8.

This species appears to be nearest *E. immacula* (Saussure and Zehntner), described from a female from Pernambuco, Brazil.

The female at hand differs from the description of that species in the somewhat smaller size, with pronotum solidly suffused, leaving only the lateral marginal portions pale and buffy, not rufescent.

We have found that the species of *Eublabeus* are separable almost entirely on features of coloration and color pattern. We know that coloration is, as a rule, though by no means invariably, unsafe for diagnostic purposes, while color pattern is often subject to decided variation, particularly when marked individual recession or intensification occurs. Thus, in *E. posticus* (Erichson) and *E. biolleyi* (Rehn), the color pattern is decidedly affected by the latter factor, the general type remaining the same.

In *argentinus* we have a form showing the maximum extension of the pronotal dark marking. Recessive examples will probably show reduction of this marking, but we feel satisfied that the material before us does not represent merely an intensive condition of some other described species and we are of the opinion that the pattern shown by less heavily marked individuals of *argentinus* will exhibit distinctive features.

Type: ♀; Mistol Passo, near Icaño, Santiago del Estero, Argentina. January and February. [Paris Museum.]

Size and form, average for the genus. Head with interocular space slightly narrower than that between the moderately large ocelli, three-fifths as wide as that between the antennal sockets. Antennae incrassate, moderately pilose. Pronotum with a distinct, rounded angulation at point of greatest width meso-cephalad. Tegmina and wings fully developed, extending beyond the apex of the abdomen a distance approximating the pronotal length. Supra-anal plate delicate, bilobate. Subgenital plate simple, large and chitinous. Ventro-cephalic margin of cephalic femora with (3 to 4) proximal and (1 or 2) distal heavy spines, between which is a fringe of elongate hairs. Ventro-cephalic margin of median and caudal femora armed with a single heavy distal spine. Ventro-caudal margin of cephalic and median femora armed with two heavy, closely placed distal spines. Ventro-caudal margin of median and caudal femora fringed with elongate hairs. Ventral margins of caudal femora unarmed. Median and caudal femora with a heavy, elongate genicular spine. Caudal metatarsus unarmed ventrad, with a large pulvillus, rounded distad, linear and running to near base of this joint; three succeeding tarsal joints with large pulvilli. Tarsal claws simple, symmetrical. Arolia absent.

Head and antennae chestnut brown, eyes prouts brown, ocelli and mouth-parts ochraceous-buff. Pronotum almost solidly blackish chestnut brown, the moderately broad lateral marginal portions apricot yellow. In the less intensively colored paratype the pro-

notum is chestnut brown, deepening to blackish along caudal margin, with flecks of the same latero-cephalad and slightly paler, approaching tawny, in large median portion of this dark area, which runs to the cephalic margin above the head, leaving only the moderately broad lateral marginal portions ochraceous-buff. Tegmina transparent, light ochraceous-buff, humeral trunk chestnut brown to slightly beyond forking of mediastine vein, the humeral vein darkened a brief distance beyond, other veins very weak ochraceous-tawny. Dorsal surface of abdomen buckthorn brown shading to Dresden brown distad on each tergite, broadly margined laterad and all but meso-proximal portion of supra-anal plate ochraceous-buff tinged with buckthorn brown. Ventral surface chestnut brown and buffy, ochraceous-tawny with buffy maculations in paratype, ventral surface of abdomen apricot yellow and broadly bordered with chestnut brown, this including all but a median fleck on the subgenital plate, the other sternites very narrowly margined laterad with buffy, in the paratype ochraceous-tawny, the darker lateral markings more suffused and breaking laterad into buffy areas on the proximal sternites. Limbs brussels brown, margins brown in paratype; the spines darker and more reddish.

The measurements for the two females are as follows, those of the type being given first. Length of body 34.7–36.3, width of interocular space 2.3–2.1, length of pronotum 10.2–10.7, width of pronotum 15.3–14.8, length of tegmen 38.3–38.8, width of tegmen 15.2–14 mm.

In addition to the type, a female paratype is before us, taken at La Palisa del Bracho, Rio Salado, Santiago del Estero, Argentina, in December.

CORYDIINAE.

CEUTHOBIA¹²²—new genus.

This genus is erected to include the Argentinian species *Melestora fulvella* Rehn and *lepta*, here described. With it, the closely allied genus *Ceuthobiella* is compared on page 247.

Genotype.—*Ceuthobia lepta* new species.

The male sex only is known for the species included.

Generic Description. Size minute, form elongate elliptical, slender when compared with the allied genera. Exposed surface very weakly to moderately supplied with minute erect hairs. Head with interocular area not rugose; distinctly wider than interval between antennal sockets. Pronotum with greatest width meso-caudad and caudal margin very broadly convex; latero-caudal oblique sulci moderately well defined, no trace of medio-longitudinal sulcation. Tegmina with first discoidal sectors longitudinal, but those toward the sutural margin oblique, veins connected by well-defined cross-

¹²² From *κεῦθος* and *βίωω*, in allusion to the secretive habits of the species.

veinlets. Wings with width much greater than half their length; costal veins clubbed distad, ulnar vein unbranched, intercalated triangle moderately large, radiate field folding fan-wise. Dorsal surface of abdomen with median segment specialized mesad. Subgenital plate asymmetrical, but not as strongly so as in *Ceuthobiella* and of a distinct general type. Ventro-cephalic margin of cephalic femora armed with (1 or 2) moderately heavy, elongate spines¹²³ succeeded by a row of minute spiniform hairs, terminated by two slender, elongate spines, elongate in increasing ratio distad; ventro-caudal margin unarmed. Median and caudal femora with a few hairs on the ventral margins, the more distal of which are replaced by spines in *lepta*, but not in *fulvella*. Pulvilli absent. Moderately well-developed arolia present between the simple, symmetrical tarsal claws.

*Ceuthobia lepta*¹²⁴ new species. Plate XIII, figures 5 and 6.

Males of the present species are recognizable by their slender form, weak pilosity of head, pronotum and tegmina, elongate tegmina with numerous costal veins, armed caudal femora and specialization of the subgenital plate.

The general type of the latter feature is much as in *C. fulvella* (Rehn), though distinctive specific difference is shown. The coloration of these two species is similar.

Type: ♂; Cordoba, Cordoba, Argentina. (E. Schulz.) [Hebard Collection, Type no. 674.]

Size very small, form very slender, surface polished and very weakly supplied with minute, erect hairs. Head projecting, surface smooth and polished, supplied with scattered, minute, erect hairs; space between antennal sockets three-quarters as wide as interocular space, the latter slightly over twice the occipital depth of the large eyes. Ocellar areas large, their flattened surfaces forming a sharp angle with the intervening area. Distal joint of maxillary palpi as long as combined length of second and third joints, expanding evenly to beyond median point, thence with ventral margin oblique to the acute apex; third joint very slightly longer than fourth. Pronotum rounded symmetrically trapezoidal in form, surface weakly convex, latero-caudal sulci of disk represented by broad and weakly concave areas diverging cephalad much as in *fulvella*, surface supplied with a few minute, erect, scattered hairs. Tegmina delicate, very elongate, with pilosity subobsolete, apex broadly rounded; costal veins numerous (13 to 14) and weakly oblique as in *fulvella*, anal field elongate pyriform, anal sulcus distinct; discoidal sectors (6) broken beyond apex of anal field, connected by moderately well developed cross-veinlets which form

¹²³ In *fulvella* decided reduction is shown, these proximal spines being absent and but one distal spine being developed.

¹²⁴ From $\lambda\epsilon\pi\tau\eta$ = slender.

rectangular interspaces, the majority regular in form. Wings fully developed, (7) costal veins heavily clubbed distad, interval between median and discoidal veins not as wide as greatest width between median and ulnar veins, supplied with transverse veinlets, ulnar vein unbranched, intercalated triangle well-developed. Median segment mesad with a V-shaped rounded ridge, the apex cephalad and supplied with agglutinated hairs, opposite this toward the cephalic margin of the segment is a small tuft of agglutinated hairs directed caudad. Supra-anal plate transverse, free margin broadly convex, showing a slight angulation. Subgenital plate asymmetrical, sinistral margin weakly convex and moderately oblique to slightly beyond median point, dextral margin weakly convex and scarcely more strongly oblique. Sinistral style springing from a slight emargination proximad on sinistral margin beneath cercus, simple, cylindrical, very slender and nearly five times as long as wide. Dextral style situated at apex of plate, simple and unarmed, very similar to sinistral style except that it is slightly bent sinistro-caudad at end of proximal third, thence tapering to the acute apex. Ventro-cephalic margin of cephalic femora supplied with (1 or 2) heavy proximal spines (in the latter case with spiniform hairs between) succeeded by a row of minute spiniform hairs, terminated by two slender, elongate spines, of which the more distal is the longer; ventro-caudal margin unarmed. Median femora with ventral margins supplied with hairs and distad with one, but no distal, slender, chaetiform spine. Caudal femora with ventro-cephalic margin armed distad with three, but no distal, well-developed though slender spines, ventro-caudal margin armed distad with two similar spines. Genicular spines of median and caudal femora small and very slender. Caudal metatarsus slightly longer than combined length of succeeding joints, pilose, with hairs of ventral surface almost spiniform, pulvilli obsolete. Arolia small, but extending slightly over half distance to apices of claws.

Head buffy suffused with ochraceous-tawny, ocelli light buff, eyes blackish mummy brown. Pronotum with disk dull ochraceous-tawny, other portions transparent, weakly tinged with ochraceous-buff as are the tegmina. Wings transparent very faintly tinged with prouts brown, except between mediastine vein and costal margin where they are paler. Abdomen ochraceous-buff, slightly suffused distad. Cerci ochraceous-tawny. Ventral surface and limbs ochraceous-buff with a slight tawny tinge, except abdomen distad, which is weakly suffused with cinnamon-brown.

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
Averias, Argentina, <i>paratype</i> ♂	7.2	1.8	1.95	7.3	2.2
Icaño, Argentina, <i>paratype</i>	7.2	1.7	—	6.7	2
Cordoba, Argentina, <i>type</i>	8.5 ¹²⁵	1.7	1.95	7.8	2.3

¹²⁵ Abdomen considerably distended.

In addition to the type, two paratype males are at hand, one from Averias, Rio Salado, Santiago del Estero, Argentina, taken in April, the other from Icaño, Rio Salado, Santiago del Estero, Argentina.

Ceuthobia fulvella (Rehn)

1913. *Melestora fulvella* Rehn, Proc. Acad. Nat. Sci. Phila., 1913, p. 283, fig. 3. [♂; Misiones, Argentina.]

Carcaraña, Santa Fé, Argentina, 5 ♂, [Hebard Cln.].

The present specimens are so much smaller than the type that we at first believed a distinct species to be represented. Careful examination shows, however, that no feature of sufficient importance occurs to warrant separation.

The specialization of the median segment of the male abdomen is the same as described for *C. lepta* on page 294. The male subgenital plate was not originally described. It is asymmetrical, with sinistral margin weakly oblique and feebly concave to beyond the mesal point, supplied at end of proximal third with a minute, simple, straight style, set in a socket; dextral margin almost straight, produced, showing slight convexity distad and there terminating at apex of plate in a large socket, in which is set the dextral style; this style rounded, with a slender, elongate spine dextrad which curves sinistrad and at its base sinistro-caudad another similar spine of about half the length. The material here recorded agrees with the type in this and all other features, except size and a very slightly greater interocular width.

Length of body 5.5–6, length of pronotum 1.3–1.3, width of pronotum 1.8–1.8, length of tegmen 5.9–6.2, width of tegmen 1.85–1.9 mm.

LANTA new genus.

This genus includes two previously unknown Argentinian species. Nearest relationship is with *Ceuthobia*, males agreeing in the small size, moderately wide and not wrinkled interocular area, comparatively large ocellar areas, general form and contour of pronotum, sinistral tegmen without a diagonal channel, generally longitudinal character of discoidal sectors, wings of similar general proportions with radiate field folding fan-wise, absence of pulvilli and presence of well developed arolia.

It differs in the more regular tegminal venation with discoidal sectors all parallel to each other but weakly oblique to the sutural margin, wings with more numerous costal veins which are thickened (not clubbed) distad, smaller intercalated triangle, unspecialized

dorsal surface of male abdomen, different character of specialization of subgenital plate and more distinct limb spination.¹²⁶

Genotype.—*Lanta scotia* new species.

Generic Description. Size minute, form moderately broad, elliptical; weakly convex surface polished, regularly but not thickly clothed with silky, erect, pile. Head with occiput slightly roughened and interocular area regularly and minutely pitted (from which spring the minute hairs), but not decidedly and irregularly rugose as in *Melestora*; interocular space wider than that between antennal sockets. Ocelli comparatively large, flat surfaces of ocellar areas forming a decided angle with plane of interocellar area. Pronotum elliptical, showing very slight flattening of the curvature of the latero-cephalic portions; surface convex, the lateral portions showing marked deflection; latero-caudal sulci of disk represented by broad and well defined concave areas, which diverge cephalad, the intervening section evenly and weakly convex. Tegmina coriaceous, bluntly elongate elliptical, but shorter and broader than in the related genera, width nearly subequal through mesal half, apex broadly rounded; numerous costal veins very strongly oblique; anal field elongate pyriform, anal sulcus distinct; discoidal sectors longitudinal or nearly so, connected by moderately well-developed cross-veinlets, which form regularly rectangulate interspaces. Wings fully developed, exceedingly delicate; costal veins thickened except near base; interval between median and discoidal veins broad, with transverse veinlets; ulnar vein bifurcate; intercalated triangle small but distinct; radiate field folding fan-wise. Dorsal surface of abdomen unspecialized.

Cephalic femora with ventro-cephalic margin armed with a single elongate spine, succeeded by a row of minute spiniform hairs, terminated by one or two elongate spines. Other ventral femoral margins, except the wholly unarmed ventro-caudal margin of the cephalic femora, supplied with minute hairs but unarmed except for a single elongate distal spine; median and caudal femora with an elongate genicular spine. Caudal tarsus about three-quarters as long as caudal tibia, succeeding joints three-quarters as long as metatarsus, pilose but with ventral surfaces unspined. Pulvilli absent. Arolia moderately large, extending to near apices of simple, symmetrical tarsal claws.

*Lanta scotia*¹²⁷ new species. Plate XIII, figures 7 and 8.

This species and *L. peniculiger*, described on page 298, are quite similar in general appearance. Known only from the male sex, the diminutive individuals are of a solidly dark brown coloration;

¹²⁶ This is due to the fact that in the present genus the few heavier spines are stout and the ventral femoral margins are not supplied with hairs which increase in size to become slender spines distad, as is true for *C. lepta* here described.

¹²⁷ From σκοτία = dark.

with tegmina comparatively broad and short, broadly rounded distad, with venation more regular than in the forms of nearest affinity.

Compared with *peniculiger*, the present species differs in the larger size, slightly less delicate character of wings and portion of dextral tegmen concealed when at rest, dorsal surface of abdomen without hairs and distinctive type of genitalic specialization.

Type: ♂; Cordoba, Cordoba, Argentina. (F. Schulz.) [Hebard Collection, Type no. 673.]

In addition to the features given in the generic description, we would note the following characters which appear to be of specific value. Interocular space slightly wider than that between antennal sockets and wider than the occipital depth of the large eyes by about one-fourth. Distal joint of maxillary palpi as long as combined length of second and third joints, expanding evenly to beyond median point, thence with ventral margin oblique to the acute apex; third joint very slightly longer than fourth. Costal veins of tegmina numerous (16 to 19, including mediastine vein and its branches) discoidal sectors (5 to 7 in series) longitudinal, except in area beyond apex of anal field where three or four are weakly oblique. Dorsal surface of abdomen without hairs. Supra-anal plate transverse, free margin broadly and evenly convex. Paired plate beneath supra-anal plate with dextral portion developed ventrad from beneath cercus in a slender, straight finger, directed mesodorsad and twice as long as the sinistral style, back of which is a large plate, subchitinous in all but peripheral portion; sinistral portion developed into a smaller though large chitinous lobe, which tapers and curves dorsad to its acute apex. Subgenital plate asymmetrical, sinistral margin weakly sinuous and very weakly oblique to slightly beyond median point, with sinistral style mesad on this margin, springing from a socket on the dorsal edge; dextral margin more strongly oblique to just before median point, from the socketed apex of the weak triangular production formed by these margins springs the dextral style. Styles small, simple; the sinistral straight two and one-half times as long as its basal width, tapering slightly to the rounded apex; the dextral style heavier, blunter and shorter, scarcely twice as long as its basal width, showing a slight curvature ventrad and with dorsal surface thickly armed with very minute spines.

General coloration deep bister. Head blackish chestnut brown; ocelli light buff, (type with ocelli discolored, dark); antennae, palpi and mouthparts snuff brown. Pronotum deep bister. Tegmina weakly transparent, heavily and evenly suffused with dresden brown, except in portion of dextral tegmen, concealed when at rest, which is transparent and very weakly suffused. Wings transparent, colorless except in area of costal veins and distad in anterior field where they are suffused with dresden brown. Dorsal surface of

abdomen cinnamon-buff, deepening to warm sepia distad, the supra-anal plate of this color, the cerci snuff brown. Limbs and ventral surface clay color; deepening to prouts brown distad on abdomen. In some of the paratypes before us the limbs and ventral surface are snuff brown, the latter becoming blackish toward the margins.

MEASUREMENTS (*in millimeters*).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Width of tegmen
♂					
Icaño, Argentina, <i>paratype</i>	6.3	1.8	2.4	6.4	2.4
Icaño, Argentina, <i>paratype</i>	6.8	1.95	2.5	6.7	2.6
La Palisa del Bracho, Argentina, <i>paratype</i>	6.8	1.95	2.6	6.4	2.4
Cordoba, Argentina, <i>type</i>	6.3	1.8	2.3	5.9	2.1

In addition to the type, three paratypic males from Icaño, Santiago del Estero, Argentina, and one paratypic male from La Palisa del Bracho, Santiago del Estero, Argentina, taken in December, have been examined.

Lanta peniculiger¹²⁸ new species. Plate XIII, figures 9 and 10.

The species is related to *L. scotia*, under which species a comparison is made on page 297.

Type: ♂; Las Garzas, Rio Las Garzas, Santa Fé, Argentina. [Paris Museum.]

We give the following characters, supplementing those described in the generic treatment. Size smaller, structure more delicate than in *scotia*. Space between antennal sockets three-quarters as wide as interocular space, the latter wider than the occipital depth of the large eyes by slightly over one-fourth. Maxillary palpi as described for *scotia*. Tegmina with numerous (15 and 16) costal veins, discoidal sectors (4 and 5) longitudinal. Dorsal surface of abdomen unspecialized, but with median segment supplied with a number of very fine microscopic hairs in median portion, succeeding tergites with fewer similar hairs mesad. Supra-anal plate transverse, free margin laterad straight, oblique, mesad straight, transverse in broad section, the angles thus formed rounded. Paired plate beneath supra-anal plate with dextral portion developed into a large plate extending to median line, subchitinous mesad, with a minute projection mesad on its ventral margin; sinistral portion as in *scotia*, developed into a smaller though large chitinous lobe, which tapers and curves dorsad to its acute apex. Subgenital plate asymmetrical, sinistral margin weakly convex and weakly oblique to median point, with sinistral style just before that point; dextral margin more strongly convex and oblique to median point, where by a sudden small offset the juncture of these margins is formed, the specialized dextral style projecting from this angulation, the

¹²⁸ The brush carrier, in allusion to the brush-like dextral style.

margins of which are subchitinous. Sinistral style simple, straight, cylindrical, about four times as long as basal width, tapering to the rounded apex; dextral style represented by a brush of agglutinated spiniform hairs, nearly as wide as the length of the sinistral style, the median length of these hairs slightly shorter than the width of the brush, this brush springing from the dorsal surface of the plate just within the free margin.

General coloration deep bister. Head blackish chestnut brown; ocelli light buff; proximal antennal joints, palpi and mouthparts prouts brown, remaining portions of antennae buckthorn brown tinged with tawny. Pronotum deep bister. Tegmina weakly transparent, heavily and evenly suffused with saccardos umber, except in portion of dextral tegmen concealed when at rest, which is hyaline, transparent, the wing beneath showing whitish. Wings transparent, almost colorless, except area of costal veins and distal margin of anterior field, where they are strongly suffused with saccardos umber. Abdomen, underparts and limbs dresden brown, the abdomen deepening to prouts brown distad.

Length of body 6, length of pronotum 1.7, width of pronotum 2, length of tegmen 5.9, width of tegmen 2.3, length of wing 5.5, width of wing 3.7 mm.

The type is unique.

Melestora argentina (Rehn) Plate XIV, figures 9 and 10.

1915. *Latindia argentina* Rehn, Proc. Acad. Nat. Sci. Phila., 1915, p. 276, figs. 2 and 3. [♂; Misiones, Argentina.]

Falls of the Rio Iguazu, Misiones, Argentina, 1 ♂.

The present insect would appear to be extremely close to *M. fuscella* Stål. Examination of the type, or material from Rio de Janeiro, Brazil, is necessary before the validity of *argentina*, or its synonymy, can be established. We have discussed the genus *Melestora* on page 250 of the present paper.

PERISPHAERINAE.

Parahormetica tumulosa Brunner

1865. *P[arahormetica] tumulosa* Brunner, Nouv. Syst. Blatt., p. 385, pl. XII, figs A to c'. [♂, ♀; Brazil.]

Villa Lutecia, near San Ignacio, Misiones, Argentina, January to April, 1 ♀, 4 juv.

In this adult, as well as in those recorded on page 254, the tegmina are immaculate. The present material is there further discussed.

The following list shows the linear arrangement of the species treated in this paper. It is furnished as an aid to the student, particularly in finding the position of the new genera and species

described, since the paper itself is divided into three sections on a geographic basis. The names of the new species, described in this study, are preceded by an asterisk.

	Page.		Page.
<i>Anaplecta bivittata</i>	222	<i>Hedaia yersiniana</i>	240
* <i>Anaplecta xanthopeltis</i>	222	* <i>Hyporhcnoda maronensis</i>	207
<i>Anaplecta pulchella</i>	195	<i>Blatta orientalis</i>	285
* <i>Anaplecta maronensis</i>	194	<i>Periplaneta americana</i>	241
* <i>Eudromiella aglaia</i>	255	<i>Periplaneta brunnea</i>	208 and 285
* <i>Dasyblatta chopardi</i>	257	<i>Leucophaea maderae</i>	241
* <i>Dasyblatta thaumasia</i>	225	<i>Pycnoscelus surinamensis</i>	241
* <i>Sciablatta poecila</i>	196	<i>Panchlora cubensis</i>	208 and 241
<i>Supella supellectilium</i>	226	<i>Panchlora thalassina</i>	285
* <i>Cariblatta mesembrina</i>	258	<i>Panchlora prasina</i>	241
<i>Neoblattella conspersa</i>	198 and 260	<i>Schizopilia fissicollis</i>	208
* <i>Neoblattella platystylata</i>	229	<i>Tribonium guttulosum</i>	285
* <i>Neoblattella janeirae</i>	226	<i>Tribonium conspersum</i>	242
<i>Neoblattella adpersicollis</i>	198 and 232	<i>Tribonium spectrum</i>	285
<i>Neoblattella puerilis</i>	262	<i>Tribonidium signaticollis</i>	242
* <i>Neoblattella tapenagae</i>	262	* <i>Tribonidium amplum</i>	243
* <i>Neoblattella eudromielloides</i>	232	<i>Zetobora emarginata</i>	209
* <i>Neoblattella berlandi</i>	234	* <i>Zetoborella gemmicula</i>	211
<i>Blattella germanica</i>	264	<i>Phortioeca nimbat</i>	212
<i>Liophilpha pumicata</i>	237	<i>Petasodes mouffeti</i>	245
* <i>Leuopeltis atopa</i>	200	<i>Monastrum biguttata</i>	246
<i>Ischnoptera ignobilis</i>	265	* <i>Blaptica interior</i>	286
* <i>Ischnoptera carcarana</i>	267	<i>Blaptica dubia</i>	290
* <i>Ischnoptera argentina</i>	270	<i>Blaberus giganteus</i>	213
<i>Ischnoptera bilunata</i>	272	<i>Blaberus fraternus</i>	290
* <i>Ischnoptera litostylata</i>	272	<i>Eublaberus biolleyi</i>	213
* <i>Ischnoptera saussurei</i>	274	* <i>Eublaberus argentinus</i>	290
* <i>Ischnoptera icano</i>	276	<i>Ceuthobiella minutissima</i>	247
<i>Liloblatta brasiliensis</i>	238 and 264	* <i>Ceuthobia lepta</i>	293
<i>Euphyllodromia literata</i>	201	<i>Ceuthobia fulvella</i>	295
* <i>Euphyllodromia chopardi</i>	202	* <i>Lanta scotia</i>	296
<i>Pseudomops neglecta</i>	278	* <i>Lanta peniculiger</i>	298
* <i>Pseudischnoptera rhabdota</i>	278	* <i>Oulopteryx dascilloides</i>	215
<i>Pseudischnoptera lineata</i>	204	* <i>Oulopteryx mouponarum</i>	247
<i>Nyctibora holosericea</i>	205	<i>Latindia dohrmiana</i>	216
<i>Nyctibora sericea</i>	239 and 281	<i>Melestora argentina</i>	250 and 299
<i>Nyctibora glabra</i>	281	<i>Specophila polybiarum</i>	216
<i>Paratropes elegans</i>	206	<i>Euthyrrhapha pacifica</i>	251
<i>Phoraspis flavipes</i>	239	<i>Hypercompsa cynipoides</i>	251
* <i>Phoraspis brachytaenia</i>	239	<i>Holocompsa nitidula</i>	217 and 251
<i>Phoraspis picta</i>	240	<i>Chorisoneura lata</i>	217
<i>Epilampra azteca</i>	206	* <i>Chorisoneura guianae</i>	217
<i>Epilampra grisea</i>	206	<i>Chorisoneura perlucida</i>	251
<i>Epilampra abdomen-nigrum</i>	206	<i>Chorisoneura gracilis</i>	252
<i>Epilampra maculicollis</i>	206	<i>Chorisoneura nigrifrons</i>	252
<i>Epilampra cinerascens</i>	281	* <i>Chorisoneura barticae</i>	219
<i>Epilampra heusseriana</i>	281	<i>Brachycola tuberculata</i>	252
* <i>Epilampra berlandi</i>	283	<i>Hormetica ventralis</i>	253
<i>Epilampra verticalis</i>	240	<i>Parahormetica tumulosa</i>	254 and 299
<i>Epilampra conspersa</i>	206	<i>Parahormetica bilobata</i>	254

EXPLANATION OF PLATES IX TO XV.

- PLATE IX.—Fig. 1. *Anaplecta xanthopeltis* new species. ♂, type. Rio Itaya, Peru. Dorsal view of wing. (×5).
 Fig. 2. *Anaplecta xanthopeltis* new species. ♂, type. Rio Itaya, Peru. Ventral view of subgenital plate. (Much enlarged).
 Fig. 3. *Anaplecta maronensis* new species. ♀, type. La Forestière, French Guiana. Dorsal view of pronotum. (×15).
 Fig. 4. *Eudromiella aglaia* new species. ♂, type. Carcaraña, Santa Fé, Argentina. Dorsal view. (×4).
 Fig. 5. *Eudromiella aglaia* new species. ♂, type. Carcaraña, Santa Fé, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 6. *Dasyblatta chopardi* new species. ♂, type. Colonia Florencia, Chaco, Argentina. Dorsal view of distal portion of abdomen. (Much enlarged).
 Fig. 7. *Dasyblatta chopardi* new species. ♂, type. Colonia Florencia, Chaco, Argentina. Ventral view of subgenital plate. (Same scale as figure 6).
 Fig. 8. *Dasyblatta chopardi* new species. ♂, type. Colonia Florencia, Chaco, Argentina. Caudal view of subgenital plate. (Same scale as figure 6).
 Fig. 9. *Dasyblatta thaumasia* new species. ♂, type. Pará, Pará, Brazil. Dorsal view of distal portion of abdomen. (Same scale as figure 6).
 Fig. 10. *Dasyblatta thaumasia* new species. ♂, type. Pará, Pará, Brazil. Ventral view of subgenital plate. (Same scale as figure 6).
 Fig. 11. *Dasyblatta thaumasia* new species. ♂, type. Pará, Pará, Brazil. Caudal view of subgenital plate. (Same scale as figure 6).
 Fig. 12. *Sciablatta poecila* new species. ♂, type. St Jean du Maroni, French Guiana. Dorsal view. (×4).
 Fig. 13. *Sciablatta poecila* new species. ♂, type. St. Jean du Maroni, French Guiana. Cephalic view of head. (×8).
 Fig. 14. *Sciablatta poecila* new species. ♂, type. St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Much enlarged).
 Fig. 15. *Sciablatta poecila* new species. ♂, type. St. Jean du Maroni, French Guiana. Lateral outline of style. (Greatly enlarged).
 Fig. 16. *Caribblatta mesembrina* new species. ♀, type. Carcaraña, Santa Fé, Argentina. Dorsal view. (×5).
 Fig. 17. *Neoblattella janeirae* new species. ♂, type. Tijuca, Rio de Janeiro, Brazil. Dorsal view of pronotum. (×4).
 Fig. 18. *Neoblattella janeirae* new species. ♂, type. Tijuca, Rio de Janeiro, Brazil. Caudal view of apex of subgenital plate. (Greatly enlarged).
 Fig. 19. *Neoblattella janeirae* new species. ♂, type. Tijuca, Rio de Janeiro, Brazil. Ventral view of subgenital plate. (Much enlarged).
 Fig. 20. *Neoblattella conspersa* (Brunner). ♂. Contamano, Rio Ucayali, Peru. Ventral view of subgenital plate (Much enlarged).
 Fig. 21. *Neoblattella platystylata* new species. ♂, type. Igarapé-Assu, Pará, Brazil. Ventral view of subgenital plate. (Same scale as figure 20).
 Fig. 22. *Neoblattella platystylata* new species. ♀, paratype. Igarapé-Assu, Pará, Brazil. Dorsal view of distal portion of subgenital plate, showing armament. (Greatly enlarged).
 Fig. 23. *Neoblattella platystylata* new species. ♀, paratype. Igarapé-Assu, Pará, Brazil. Caudal view of distal portion of subgenital plate, showing armament. (Same scale as figure 22).
- PLATE X.—Fig. 1. *Neoblattella platystylata* new species. ♀, paratype. Igarapé-Assu, Pará, Brazil. Cephalic view of head. (Much enlarged).
 Fig. 2. *Neoblattella eudromielloides* new species. ♂, type. Passa-Quatro, Minas Geraes, Brazil. Dorsal view of pronotum. (×6).
 Fig. 3. *Neoblattella eudromielloides* new species. ♂, type. Passa-Quatro,

- Minas Geraes, Brazil. Ventral view of subgenital plate. (Much enlarged).
 Fig. 4. *Neoblattella eudromielloides* new species. ♂, *type*. Passa-Quatro, Minas Geraes, Brazil. Caudal view of subgenital plate. (Greatly enlarged).
 Fig. 5. *Neoblattella berlandi* new species. ♂, *type*. Upper Amazon Basin, between Peru and Bolivia. Dorsal view. (×4).
 Fig. 6. *Neoblattella berlandi* new species. ♂, *type*. Upper Amazon Basin, between Peru and Bolivia. Ventral view of subgenital plate. (Same scale as figure 3).
 Fig. 7. *Neoblattella berlandi* new species. ♂, *type*. Upper Amazon Basin, between Peru and Bolivia. Caudal view of subgenital plate. (Same scale as figure 3).
 Fig. 8. *Neoblattella tapenagae* new species. ♀, *type*. Colonia Florencia, Chaco, Argentina. Dorsal view. (×3).
 Fig. 9. *Liosilpha pumicata* (Stål). ♀. Tijuca, Rio de Janeiro, Brazil. Cephalic outline of cephalic femur. (Much enlarged).
 Fig. 10. *Liosilpha pumicata* (Stål). ♀. Tijuca, Rio de Janeiro, Brazil. Distal outline of tarsal claws and arolium. (Greatly enlarged).
 Fig. 11. *Leuropeltis atopa* new species. ♂, *type*. Gourdonville, French Guiana. Dorsal view. (×3).
 Fig. 12. *Leuropeltis atopa* new species. ♂, *type*. Gourdonville, French Guiana. Cephalic outline of cephalic femur. (Much enlarged).
 Fig. 13. *Leuropeltis atopa* new species. ♂, *type*. Gourdonville, French Guiana. Ventral view of subgenital plate. (Much enlarged).
 Fig. 14. *Litoblatta brasiliensis* (Brunner). ♂. Cordoba, Cordoba, Argentina. Dorsal view (×3).
 Fig. 15. *Litoblatta brasiliensis* (Brunner). ♂. Cordoba, Cordoba, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 16. *Litoblatta brasiliensis* (Brunner). ♀. San Rafael, Mendoza, Argentina. Dorsal outline. (×3).
 Fig. 17. *Litoblatta brasiliensis* (Brunner). ♀. San Rafael, Mendoza, Argentina. Dorsal-caudal view of distal portion of abdomen, showing the manner in which the sixth tergite (A) is produced over the supra-anal plate (B).¹²⁹

- PLATE XI.—Fig. 1. *Ischnoptera carcarana* new species. ♂, *type*. Carcaraña, Santa Fé, Argentina. Dorsal outline. (×4).
 Fig. 2. *Ischnoptera carcarana* new species. ♂, *paratype*. Carcaraña, Santa Fé, Argentina. Dorsal outline of head, pronotum and tegmina, showing the brachypterous form. (×4).
 Fig. 3. *Ischnoptera carcarana* new species. ♂, *type*. Carcaraña, Santa Fé, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 4. *Ischnoptera argentina* new species. ♂, *type*. San Nicolas, Buenos Aires, Argentina. Ventral view of supra-anal plate, showing appendages at bases of cerci. (Much enlarged).
 Fig. 5. *Ischnoptera argentina* new species. ♂, *paratype*. San Nicolas, Buenos Aires, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 6. *Ischnoptera argentina* new species. ♀, *allotype*. San Nicolas, Buenos Aires, Argentina. Dorsal view of supra-anal plate. (Much enlarged).
 Fig. 7. *Ischnoptera litostylata* new species. ♂, *type*. Las Garzas, Santa Fé, Argentina. Dorsal view of supra-anal plate. (Much enlarged).
 Fig. 8. *Ischnoptera litostylata* new species. ♂, *type*. Las Garzas, Santa Fé, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 9. *Ischnoptera saussurei* new species. ♂, *type*. Carcaraña, Santa Fé, Argentina. Dorsal view of supra-anal plate. (Much enlarged).
 Fig. 10. *Ischnoptera saussurei* new species. ♂, *type*. Carcaraña, Santa Fé, Argentina. Ventral view of subgenital plate. (Much enlarged).

¹²⁹ In direct dorsal aspect, a very narrow caudal marginal portion of the subgenital plate is alone visible.

- Fig. 11. *Ischnoptera icano* new species. ♂, *type*. Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. Dorsal view of pronotum. ($\times 7$).
- Fig. 12. *Ischnoptera icano* new species. ♂, *type*. Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. Dorsal view of supra-anal plate. (Much enlarged).
- Fig. 13. *Ischnoptera icano* new species. ♂, *type*. Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. Ventral view of subgenital plate. (Much enlarged).
- Fig. 14. *Pseudischnoptera lineata* (Olivier). ♂. St. Jean du Maroni, French Guiana. Ventral view of subgenital plate. (Much enlarged).
- Fig. 15. *Pseudischnoptera rhabdota* new species. ♂, *type*. Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. Dorsal view. ($\times 3$).
- Fig. 16. *Pseudischnoptera rhabdota* new species. ♂, *type*. Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. Ventral view of subgenital plate. (Much enlarged).
- Fig. 17. *Pseudischnoptera rhabdota* new species. ♀, *paratype*. Border of Rio Salado, near Icaño, Santiago del Estero, Argentina. Dorsal outline. ($\times 3$).

- PLATE XII.—Fig. 1. *Epilampra berlandi* new species. ♂, *type*. Icaño, Santiago del Estero, Argentina. Dorsal view. ($\times 4$).
- Fig. 2. *Epilampra berlandi* new species. ♂, *type*. Icaño, Santiago del Estero, Argentina. Cephalic view of head. ($\times 9$).
- Fig. 3. *Hedaia yersiniana* (Saussure). ♂. Curityba, Paraná, Brazil. Dorsal view¹³⁰. ($\times 1\frac{1}{4}$).
- Fig. 4. *Hedaia yersiniana* (Saussure). ♂. Curityba, Paraná, Brazil. Dorsal outline of pronotum. ($\times 1\frac{1}{4}$).
- Fig. 5. *Hyporhynchota mironensis* new species. La Forestière, French Guiana. Dorsal view. ($\times 2$).
- Fig. 6. *Schizopilia fissicollis* (Serville). ♂. St. Laurent du Maroni, French Guiana. Dorsal outline of pronotum. ($\times 1\frac{1}{2}$).
- Fig. 7. *Tribonivum conspersum* (Guerin and Percheron). Immature ♂. Tijuca, Rio de Janeiro, Brazil. Dorsal view. ($2\frac{1}{8}$).
- Fig. 8. *Tribonidium signaticollis* (Burmeister). ♂. Curityba, Paraná, Brazil. Dorsal view. ($\times 3$).
- Fig. 9. *Tribonidium amplum* new species. ♂, *type*. Tijuca, Rio de Janeiro, Brazil. Dorsal view. ($\times 3$).
- Fig. 10. *Tribonidium amplum* new species. ♀, *allotype*. Tijuca, Rio de Janeiro, Brazil. Dorsal outline. ($\times 3$).
- Fig. 11. *Zetobora emarginata* Burmeister. ♂. La Forestière, French Guiana. Dorsal outline of pronotum. ($\times 3$).
- Fig. 12. *Zetobora emarginata* Burmeister. ♀. La Forestière, French Guiana. Dorsal outline of pronotum. ($\times 3$).

- PLATE XIII.—Fig. 1. *Zetoborella gemmicula* new species. ♂, *type*. St. Jean du Maroni, French Guiana. Dorsal view. ($\times 3$).
- Fig. 2. *Zetoborella gemmicula* new species. ♀, *allotype*. St. Jean du Maroni, French Guiana. Dorsal view of pronotum. ($\times 3$).
- Fig. 3. *Phortioeca nimbata* Burmeister. ♂. La Forestière, French Guiana. Dorsal view. ($\times 2\frac{1}{2}$).
- Fig. 4. *Petasodes mouffeti* (Kirby). Immature ♀. Tijuca, Rio de Janeiro, Brazil. Dorsal view. ($\times 1\frac{1}{2}$).
- Fig. 5. *Ceuthobia lepta* new species. ♂, *type*. Cordoba, Cordoba, Argentina. Dorsal view. ($\times 6$).
- Fig. 6. *Ceuthobia lepta* new species. ♂, *type*. Cordoba, Cordoba, Argentina. Ventral view of subgenital plate. (Much enlarged).

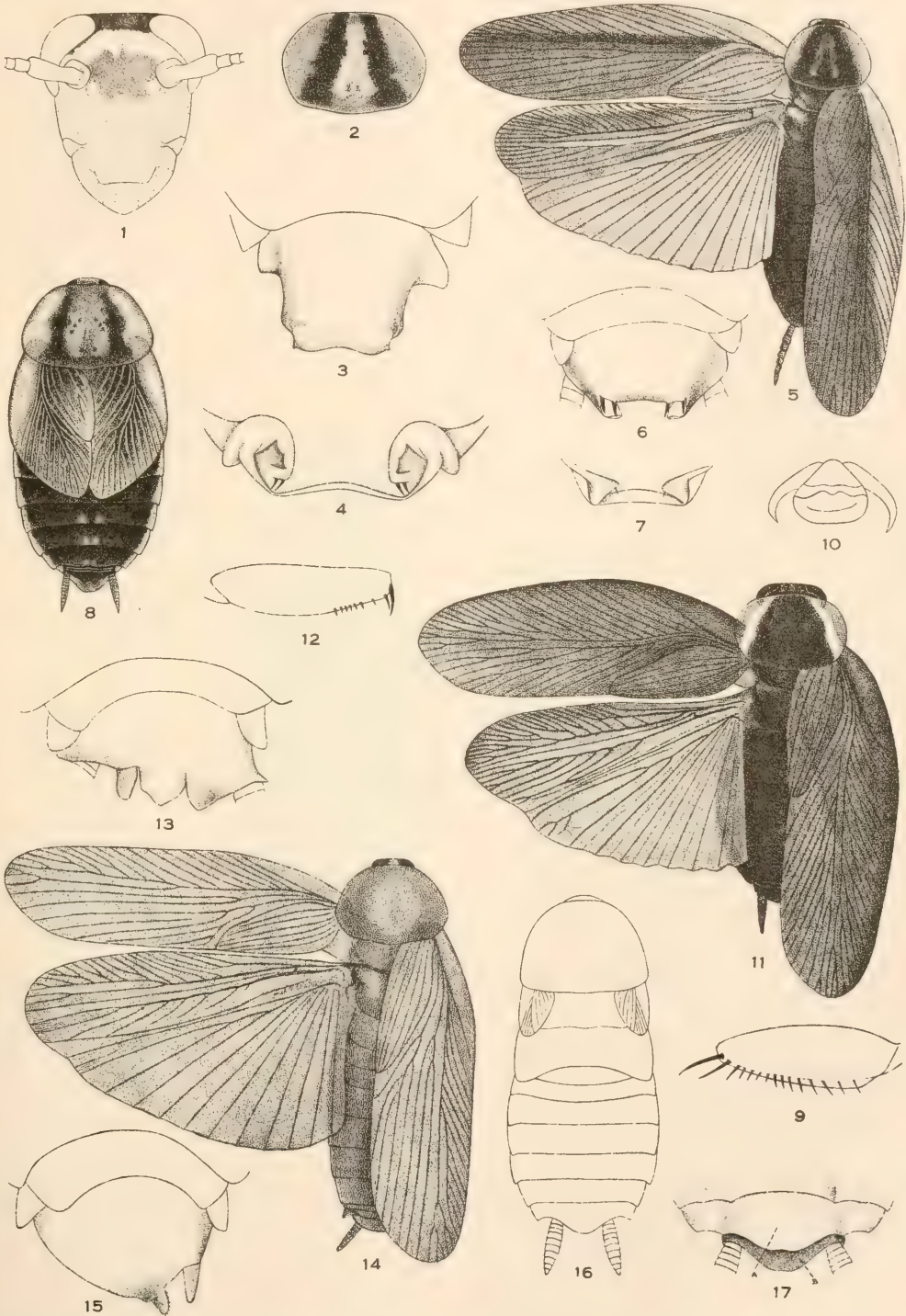
¹³⁰ Due to the decided declivity cephalad of the pronotum, this dorsal view of the entire insect actually gives a dorsal-caudal view of the pronotum. We have heretofore given a directly dorsal outline of the pronotum itself in figure 4.

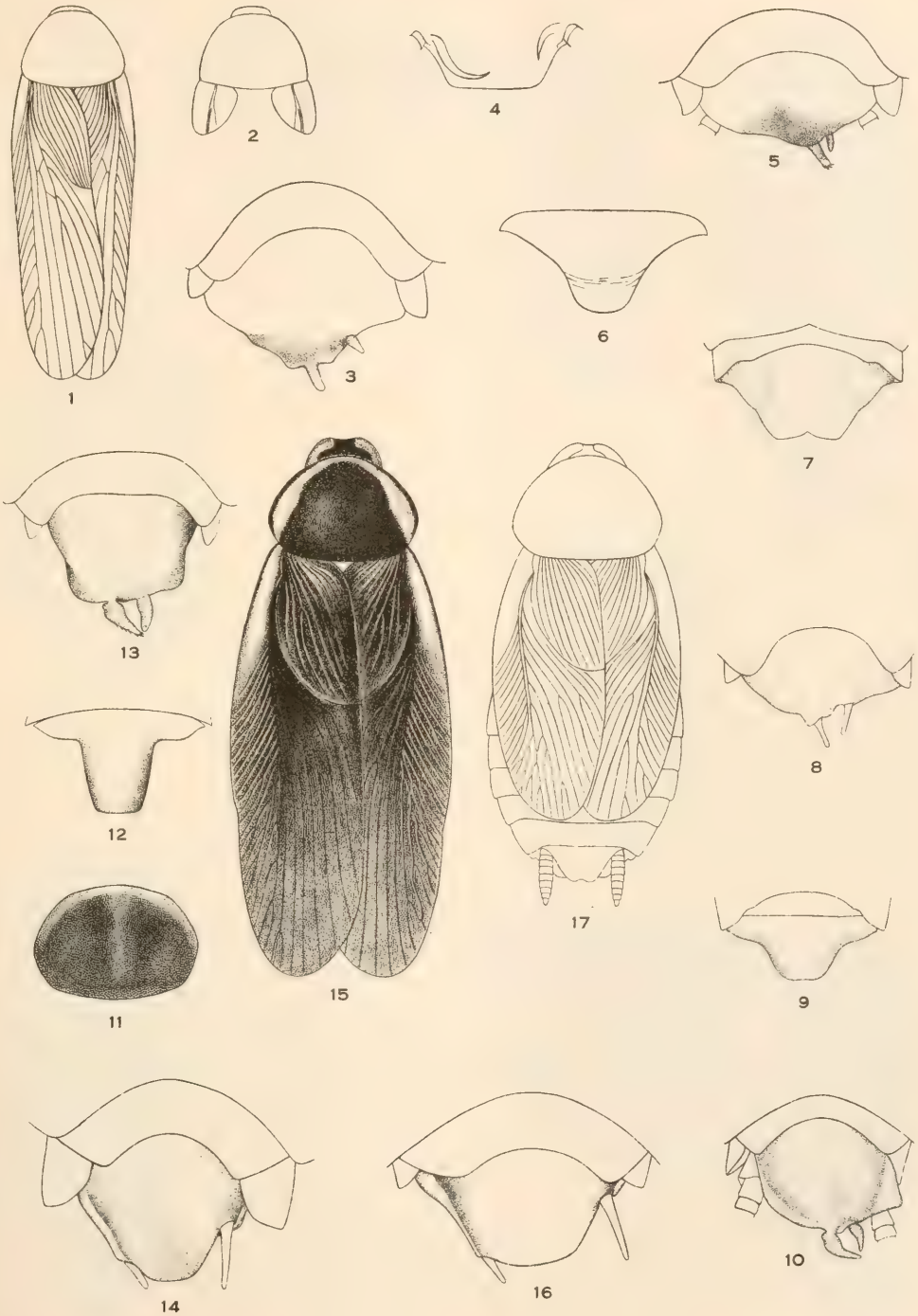
- Fig. 7. *Lanta scotia* new species. ♂, *type*. Cordoba, Cordoba, Argentina. Dorsal view. ($\times 6$).
 Fig. 8. *Lanta scotia* new species. ♂, *type*. Cordoba, Cordoba, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 9. *Lanta peniculiger* new species. ♂, *type*. Las Garzas, Santa Fé, Argentina. Ventral view of subgenital plate. (Much enlarged).
 Fig. 10. *Lanta peniculiger* new species. ♂, *type*. Las Garzas, Santa Fé, Argentina. Dorsal view of the simple sinistral and remarkably specialized dextral style. (Greatly enlarged).

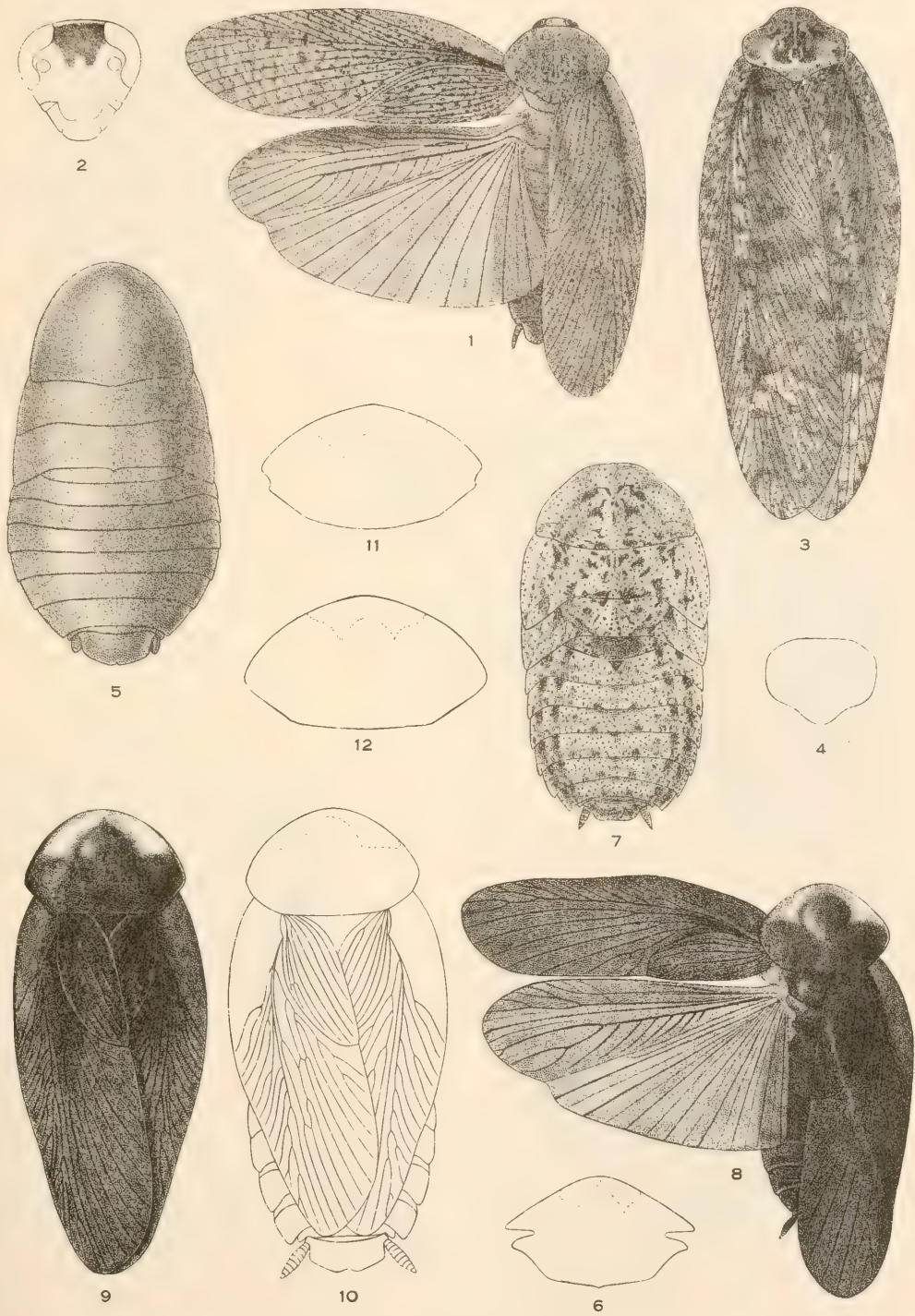
- PLATE XIV.—Fig. 1. *Blaptica interior* new species. ♂, *type*. Cordoba, Cordoba, Argentina. Dorsal view. ($\times 1\frac{3}{4}$).
 Fig. 2. *Blaptica dubia* (Serville). ♂. Cordoba, Cordoba, Argentina. Dorsal view. ($\times 1\frac{3}{4}$).
 Fig. 3. *Eublabeus biolleyi* (Rehn). ♀, *type*. Plains of Santa Clara, Reventazon River, Costa Rica. Dorsal view of pronotum. ($\times 1\frac{1}{2}$).
 Fig. 4. *Eublabeus biolleyi* (Rehn). ♀. Cabima, Panama. Dorsal view of pronotum. ($\times 1\frac{1}{2}$).
 Fig. 5. *Eublabeus biolleyi* (Rehn). ♂. St. Jean du Maroni, French Guiana. Dorsal view of pronotum. ($\times 1\frac{1}{2}$).
 Fig. 6. *Eublabeus biolleyi* (Rehn). ♀. Caparo, Trinidad. Dorsal view of pronotum. ($\times 1\frac{1}{2}$).
 Fig. 7. *Eublabeus biolleyi* (Rehn). St. Jean du Maroni, French Guiana. Dorsal view of pronotum. ($\times 1\frac{1}{2}$).
 Fig. 8. *Eublabeus argentinus* new species. ♀, *type*. Mistol Passo, Santiago del Estero, Argentina. Dorsal view of pronotum ($\times 1\frac{1}{2}$).
 Fig. 9. *Melestora argentina* (Rehn). ♂. Falls of the Rio Iguazu, Misiones, Argentina. Dorsal outline of sinistral tegmen. ($\times 5\frac{1}{2}$).
 Fig. 10. *Melestora argentina* (Rehn). ♂. Falls of the Rio Iguazu, Misiones, Argentina. Dorsal outline of wing. ($\times 5\frac{1}{2}$).
 Fig. 11. *Chorisoneura guianae* new species. ♂, *type*. Bartica, British Guiana. Dorsal view of the tegmen. ($\times 5$).
 Fig. 12. *Chorisoneura guianae* new species. ♂, *type*. Bartica, British Guiana. Ventral view of subgenital plate. (Much enlarged).
 Fig. 13. *Chorisoneura barticae* new species. ♂, *type*. Bartica, British Guiana. Ventral view of subgenital plate. (Much enlarged).

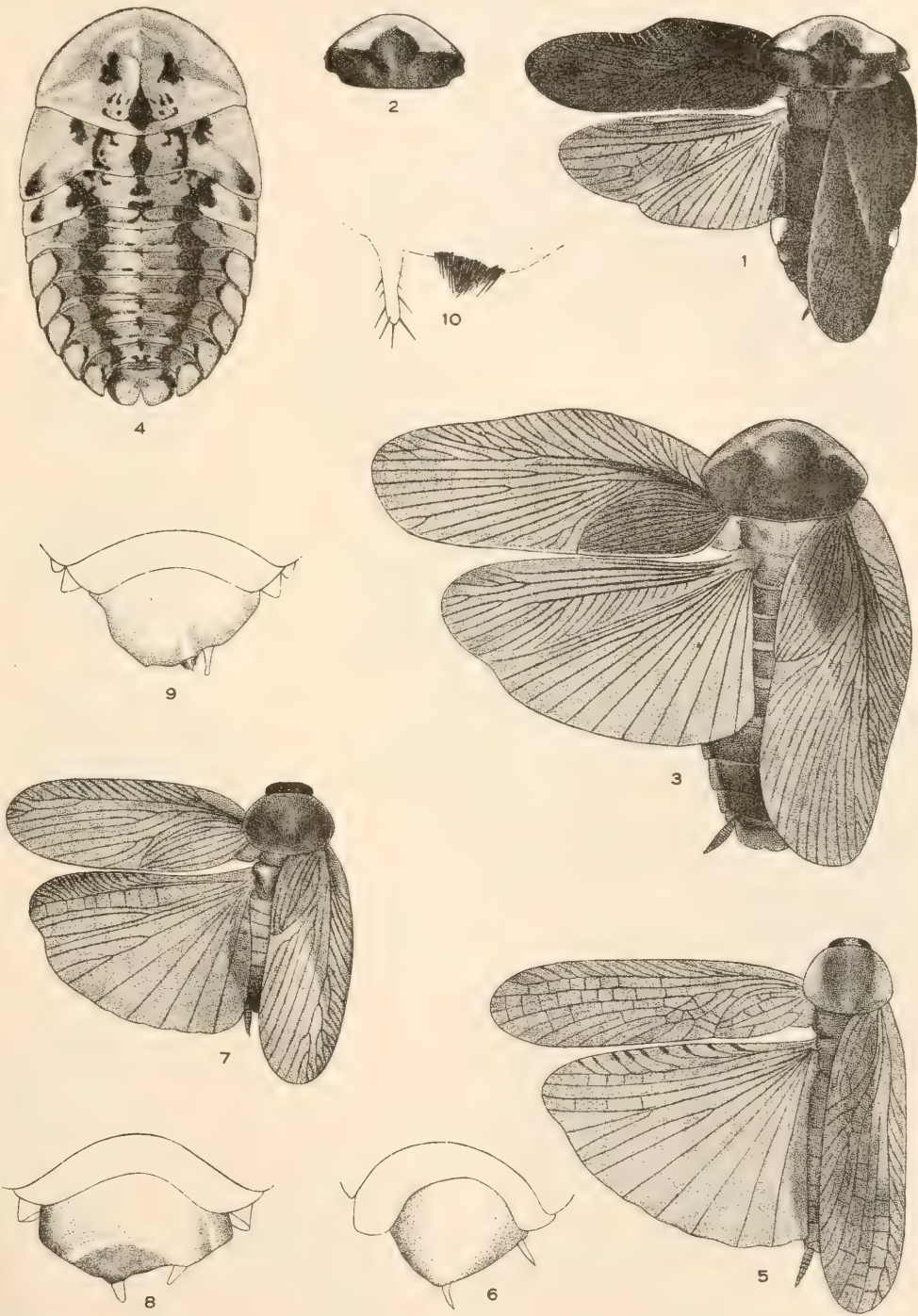
- PLATE XV.—Fig. 1. *Euphyllodromia chopardi* new species. ♂, *type*. Bartica, British Guiana. Dorsal view. ($\times 4$).
 Fig. 2. *Euphyllodromia chopardi* new species. ♂, *type*. Bartica, British Guiana. Ventral view of subgenital plate. (Much enlarged).
 Fig. 3. *Phoraspis brachytaenia* new species. ♂, *type*. State of Santa Catharina, Brazil. Dorsal view of sinistral tegmen. ($\times 2\frac{1}{2}$).
 Fig. 4. *Phoraspis picta* (Drury). ♂, *topotype*. Tijuca, Rio de Janeiro, Brazil. Dorsal view of sinistral tegmen. ($\times 2\frac{1}{2}$).
 Fig. 5. *Oulopteryx dascilloides* new species. ♂, *type*. Pariacabo, French Guiana. Dorsal view. ($\times 5$).
 Fig. 6. *Oulopteryx dascilloides* new species. ♂, *type*. Pariacabo, French Guiana. Ventral view of subgenital plate. (Much enlarged).
 Fig. 7. *Oulopteryx meliponarum* new species. ♂, *type*. Fazenda do Sobrado, Minas Geraes, Brazil. Dorsal view. ($\times 5$).
 Fig. 8. *Oulopteryx meliponarum* new species. ♂, *type*. Fazenda do Sobrado, Minas Geraes, Brazil. Caudal view of supra-anal plate and fang-like processes beneath it, within the anal chamber. (Greatly enlarged).
 Fig. 9. *Oulopteryx meliponarum* new species. ♂, *type*. Fazenda do Sobrado, Minas Geraes, Brazil. Ventral view of subgenital plate. (Same scale as figure 6).
 Fig. 10. *Oulopteryx meliponarum* new species. ♀, *paratype*. Fazenda do Sobrado, Minas Geraes, Brazil. Ventral view of subgenital plate. (Same scale as figure 6).

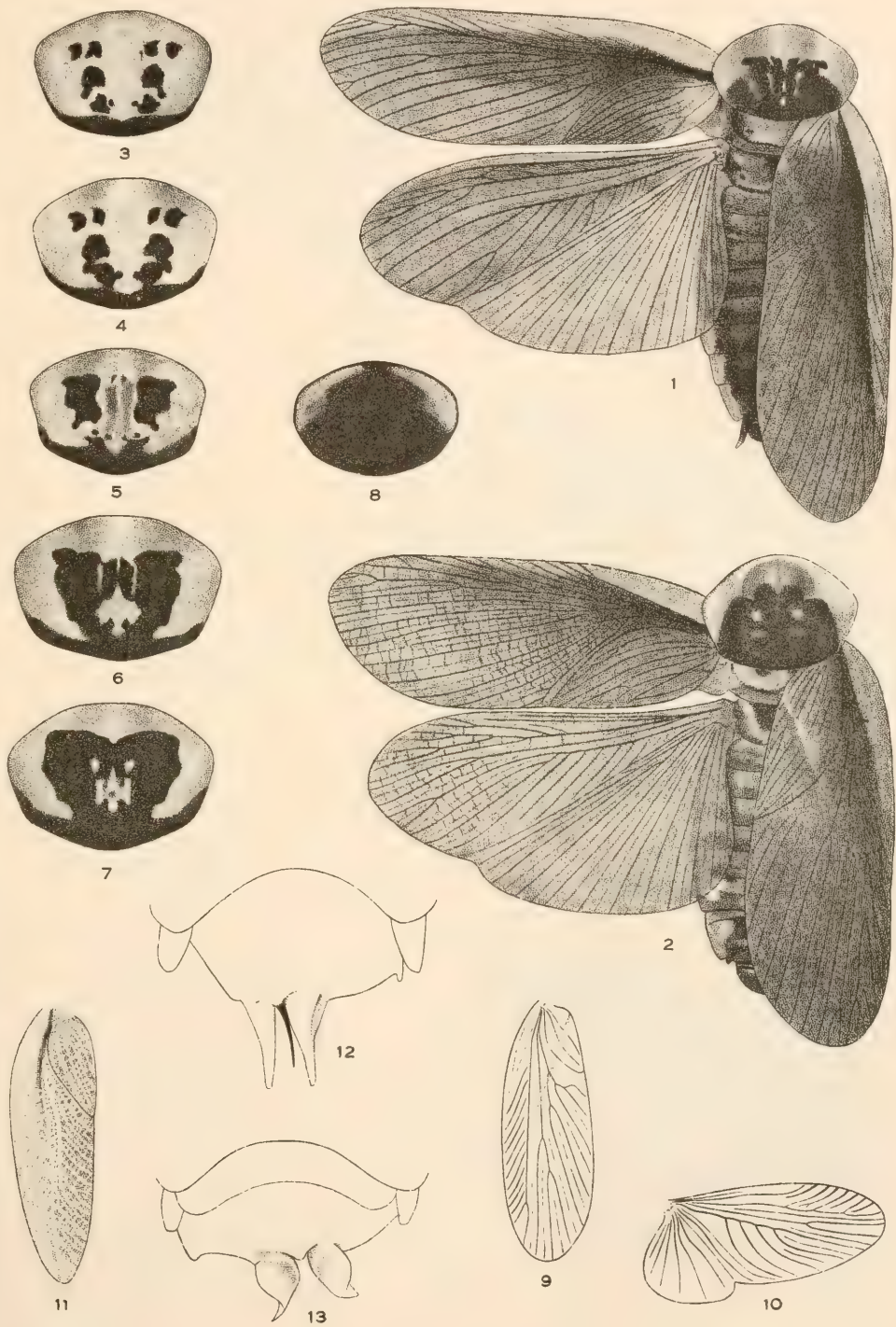














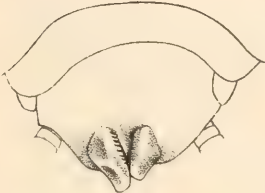
1



3



4



2



7



8



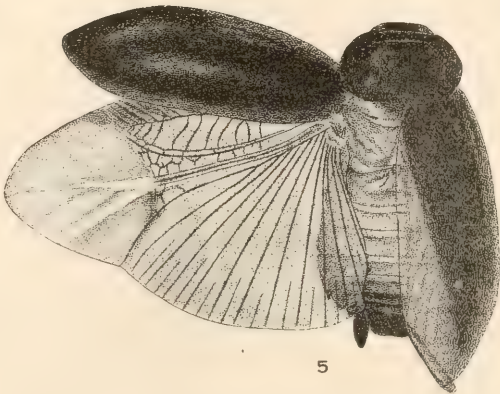
9



10



6



5

REVISION OF W. M. GABB'S TERTIARY MOLLUSCA
OF SANTO DOMINGO.

BY HENRY A. PILSBRY.

The Tertiary beds of northern Santo Domingo were first brought to scientific notice by the receipt in London of a collection of fossils made by Mr. T. S. Heneken,¹ and described by J. Carriker Moore and G. B. Sowerby.² Subsequently Mr. Heneken reported on the geology and Mr. Moore on another sending of fossils.³ The Heneken collection also served as the basis of a paper by Mr. R. J. L. Guppy,⁴ describing further species, and for numerous notes in other publications by the same author.

William More Gabb, in the course of a geological reconnaissance of Santo Domingo in the years 1869-1871, collected extensively in and about the region covered by Mr. Heneken's work. His observations on the geology and descriptions of the fossils were published by the American Philosophical Society,⁵ and the fossils were presented to The Academy of Natural Sciences of Philadelphia. Unfortunately, Gabb was not able to figure his species. The descriptions are not always sufficiently full to insure their recognition when encountered in other beds except by reference to the original specimens. The progress of tropical American paleontology has undoubtedly been impeded by the uncertainty attaching to many of Gabb's Santo Domingan species.

A certain number of fossils of Santo Domingo and Haiti have been described or discussed by Dr. W. H. Dall, in his great work on the Tertiary fauna of Florida and in the Proceedings of the U. S. National Museum. Others have been published by Dr. A. P. Brown and the writer in papers on fossils of the Canal Zone, Colombia, and Haiti.

¹ Mr. Heneken's name was spelled Heniker in the original publication.

² Quarterly Journal of the Geological Society, vol. vi, 1849.

³ Same Journal, vol. ix, 1853.

⁴ Quarterly Journal of the Geological Society, vol. 32, 1876, pp. 516-532.

⁵ Notes on the Topography and Geology of Santo Domingo. Trans. American Philosophical Society, XV, pp. 49-259. Separate copies with special title-page dated 1873. The exact date of publication remains uncertain. Dr. I. Minis Hays, Secretary of the Society, informs me that the records of the Publication Committee were not preserved; but a proof of Gabb's map was exhibited at the meeting of October 2, 1873. The paper was reviewed in the American Journal of Science for March, 1874. It may be inferred that the work was not actually distributed until late in 1873 or early in 1874. In the absence of proof to the contrary, the date of the title-page may be accepted.

Gabb described the new genera and illustrated their type species in: Description of some new genera of Mollusca. Proc. A. N. S. Phila. for 1872, pp. 270-274, pl. 9-11, published Feb. 11, 1873.

Some years ago Mr. Charles W. Johnson and the writer undertook to supplement Gabb's work by the preparation of figures of his type specimens with notes on these and other specimens contained in his collection. The work was interrupted by Mr. Johnson's removal to Boston, and its completion, devolving upon the senior author alone, was delayed by the pressure of other duties. The paper was finally submitted to the Academy for publication February 27, 1917,⁶ Under existing conditions prompt publication could not then be made, so that an extract containing descriptions of new species was published.⁷ Meantime, Miss C. J. Maury had issued the text of a report on the geology and paleontology of Santo Domingo,⁸ anticipating the appearance of our paper by a few days. Having access to a partial set of Gabb's specimens, Miss Maury, with great enterprise, anticipated our revision by renaming certain of the Gabb species having invalid names, and described others from his collection. In now publishing our notes and figures, such synonymyas was obvious in looking over Miss Maury's work has been noted, and some paragraphs which now appear superfluous have been deleted; otherwise the paper is left as originally written.⁹ When a critical comparison of the Gabb and Maury specimens can be made doubtless some further cases of identity will be apparent; but it is clear that each collection contains many species not in the other. It is an evidence of the remarkable richness of the faunas.

Gabb had selected a type series of his fossils. In a few cases which we have noted below, his trays contained more than one form, but practically all of the species described by us as new were shells which Gabb had determined incorrectly, others which he had set aside as duplicates; or they were selected from packages which, from their condition and the dates of newspapers used as wrappings, apparently had not been opened since they were packed in Santo Domingo.

⁶ Proc. A. N. S. Phila., 1917, p. 82.

⁷ New Mollusca of the Santo Domingan Oligocene, by H. A. Pilsbry and C. W. Johnson. Proc. A. N. S. Phila., 1917, pp. 150-202. The separate copies were dated May 4, but on the reverse of title-page of the Proceedings the date is given as May 5, 1917.

⁸ Santo Domingo Type Sections and Fossils. Bull. American Paleontology, v, pp. 1-129 March 31, 1917, pp. 121-251, April 20, 1917. The plates appeared May 29, 1917.

⁹ Certain recent changes in generic nomenclature might have been adopted, but it seemed better to leave the latter uniform with our paper of 1917. The valuable papers of C. W. Cooke, 1919, and B. Hubbard, 1920, were received since this paper was completed.

With two exceptions¹⁰ the species enumerated in Gabb's paper are furnished with labels (names only) in his hand, under card labels written by Professor Heilprin; all of the small species were in vials, the large ones loose in the trays. We found no cases of transposition of specimens, and with two exceptions¹¹ every species or specimen mentioned by Gabb has been found, together with its proper label.

With two or three exceptions, none of the labels bore any indications of locality or horizon further than "Santo Domingo." What little information exists of more definite character is contained in Gabb's paper, or sometimes may be inferred from his specific names. The zonal relations of many of the species have been determined by Miss Maury.

In a few cases the gangue indicates that certain species are from the *Orthaulax* zone, which is apparently synchronous with the Tampa Silex beds, while the remainder so far as we can judge is later, having much in common with the Gatun and Bowden beds, now generally considered Miocene. This was also Gabb's opinion.

Gabb's descriptions give evidence of haste and the use of a lens of low power only. Dimensions of the shells were often omitted, and when given are almost invariably inexact, as though estimated rather than actually measured. There are many typographical errors, due to the circumstance that the paper was printed after his departure for Costa Rica. He did not see the proofs. We note these things merely to account for occasional discrepancies between the original descriptions and the supplementary descriptive notes to be found in this revision.

Certain species not Santo Domingan have been named incidentally in the course of this work, as follows:

Conus maculospira n.n. for *planiliratus* Sowerby. Recent.

Conus consobrinus ultimus Pils. & Johns. Pliocene, Costa Rica.

Conus pseudomarginatus, n. n. for *C. marginatus* Cossm., not Sowb. Martinique.

Xancus textilis jamaicensis. Bowden, Jamaica Miocene.

Bursa crassa bowdenensis. Bowden, Miocene.

Cypræa raymondrobertsi bowdenensis. Bowden, Miocene.

Pyramidella insularum, n. n. for *P. canaliculata* Sowb. Recent.

¹⁰ ¹¹ The specimens of *Tellina alternata* and *T. punicea* (?) in the collection have lost their labels; it is not certain that they are Gabb's examples, or that the former is from Santo Domingo.

Arca idiodon. Wilmington, N. C.

Pecten uselmæ Pils. & Johns. Bowden, Miocene.

PTEROPODA.

LIMACINIDAE.

Limacina inflata (Orbigny) Text-fig. 1.

Planorbella imitans Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 201; Proc. A. N. S. Phila. 1872, p. 270, pl. 11, fig. 2 (1873).

Atlanta inflata Orbigny, Voy. dans l'Amer. Mécrid. v, p. 174, pl. 12, figs. 16-19.

Limacina inflata (d'Orb.), Pelseneer, Challenger Reports, Zoology, xxiii, p. 17.

Gabb's figure of this species is poor, giving the idea of a bilater-



Fig. 1. *Planorbella imitans* Gabb, upper, profile and basal views of the type (= *Limacina inflata*).



Fig. 2. *Vaganella undulata* (Gabb), two views of the type.

ally symmetrical discoidal spiral, whereas the spire is very little sunken, and the umbilicus is deep. The type is somewhat broken and not quite mature, 1 mm. in diameter. We do not hesitate to refer it to the recent *L. inflata*, for which there are many Atlantic and Antillean records.

Besides the type of *Planorbella imitans*, no. 2895 A. N. S. P., there are two smaller examples and some fragments.

The term *Planorbella* Gabb (not Haldeman) may be added to the synonymy of *Limacina*. It is identical with *Embolus*, which includes openly umbilicate Limacinas with slightly sunken spire, and more or less of a median projection of the lip in the adult stage.

Vaganella undulata (Gabb) Text-fig. 2.

Balantium undulatum Gabb, Trans. Amer. Philos. Soc, xv, 1873, p. 200.

The curved shell, with three low waves on the concave side, is characteristic. Length 6.5, greatest diameter 1.8 mm.

Type no. 2892 A. N. S. P. One specimen.

Styliola sulcifera Gabb. Text-fig. 3.

S. sulcifera Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 200.

This is a rather rapidly tapering species, with the sulcus slightly spiral. The section is not quite circular. The larger end is broken as shown in the figure.

Length 3.9, diameter at larger end 0.9, at smaller 0.3 mm.

Type is no. 2893 A. N. S. P.

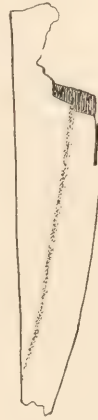


Fig. 3. *Styliola sulcifera* Gabb, lateral view and outline of oral end.

Diacria bisulcata Gabb. Text-fig. 4.

Diacria bisulcata Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 200.

The broader, smooth, mesial convexity will distinguish this species



Fig. 4. *Diacria bisulcata*, Gabb, type.

from the recent *D. trispinosa*. The type, no. 2894 A. N. S. P., measures, length 4.3, width 4.2, thickness 1.4 mm.

GASTROPODA.

TECHTIBRANCHIATA.

ACTEONIDAE.

Acteon subornatilis Pils. and Johns. Plate XXIII, fig. 15.
Proc. A. N. S. Phila. 1817, p. 150.

Acteon punctostriatus (C. B. Ad.)

Actæon cubensis Orb., Gabb, Trans. Amer. Philos. Soc. xv, p. 245.

Actæon riomaensis Maury, Bull. Amer. Pal. V, p. 11.

Somewhat abundant. Another decidedly more slender species is represented by one imperfect shell.

Rictaxis oryza (Gabb) Plate XXIII, fig. 12.

Actæonidea oryza Gabb, Tr. Amer. Philos. Soc. xv, p. 245; Proc. A. N. S. Phila. 1872, p. 273, pl. 11, figs. 8, 8a (Feb. 11, 1873).

This species is type of *Actæonidea* Gabb. The sole specimen, no. 3181 A. N. S. P., measures, length 6.7, diam. 2.5 mm.

ACTEOCINIDAE.

Tornatinidae of authors.

Acteocina canaliculata (Say)

Acteocina wetherilli (Lea)

Tornatina wetherilli Lea, Dall, Trans. Wagn. Inst. iii, p. 15.

Tornatina coixlacryma Guppy, Geol. Mag. iv, p. 500.

Acteocina recta (Orb.)

Tornatina recta Orb., Gabb, Tr. Amer. Philos. Soc. xv, p. 246.

Acteocina candei (Orbigny)

All of these species were taken in some abundance.

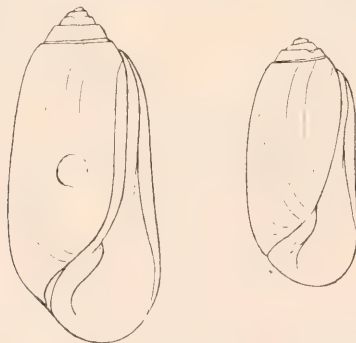


Fig. 5. *Acteocina subbullata* P. and J.

Acteocina subbullata Pils. and Johns. Text-fig. 5.

Proc. A. N. S. Phila. 1917, p. 150.

Retusa biforis Pils. and Johns. Text-fig. 8.

Proc. A. N. S. Phila. 1917, p. 151.

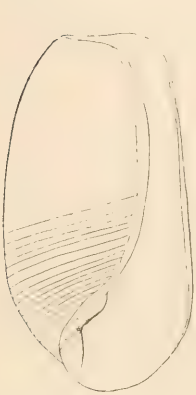


FIG. 6.
Cylichnella bidentata (Orb.)
(recent)



FIG. 7.
Cylichnella ovum-
lacerti (Guppy).



FIG. 8.
Retusa biforis P. & J.

Retusa sulcata fossilis n. subsp.

Cf. *Bulla sulcata* Orb., Moll. Cuba i, p. 129, pl. 4bis, figs. 9-12.

Cylichna sulcata d'Orb. Gabb, Trans. Amer. Philos. Soc. xv, p. 245.

The fossils agree in sculpture with *R. sulcata* but they are larger and relatively narrower, three of the largest measuring:

Length 2.8, diam. 1.15 mm.

Length 2.8 diam. 1.35 mm.

Length 2.9, diam. 1.25 mm.

The last two are conspicuously swollen near the base.

Type no. 3186 A. N. S. P.

Cylichnella ovumlacerti (Guppy) Text-fig. 7.

Cylichnella bidentata d'Orb., Gabb, Trans Amer. Philos. Soc. xv, 1873, p. 246;

Proc. A. N. S. Phila. 1872, p. 273. Not *Bulla bidentata* d'Orbigny.

Tornatina (*Cylichnella*) *ovum-lacerti* Guppy, Dall, Proc. U. S. Nat. Mus. XVIII, p. 27.

The Santo Domingan shells are cylindric-oblong, obtusely rounded below, narrowly truncate at summit; glossy, encircled by many impressed spiral lines in the lower half. The vertex is concave, surmounted by a rather sharp keel. Aperture somewhat racket-shaped. Columella having a strong, upperspiral plait which continues to the outer edge of the columellar callus, and a small, subvertical, sigmoid fold below. Outer lip very thick, bevelled to the edge.

Length 4, diam. 2.4 mm.

This species is far more solid than *C. bidentata* (Orb.), and constantly broader in a considerable series of both examined. For comparison a figure is given of a specimen of *C. bidentata* measuring length 3.7, diam. 1.9 mm., from *Albatross* Station 2275, off North Carolina (Text-fig. 6).

The only published figure of *C. ovumlacerti* is so inadequate that one of Gabb's specimens is illustrated in text-fig. 7.

Cylichna (?) aff. *Cylichnella bidentata* d'Orb., of Toulou, Jahrb. K. K. Geol. Reichsanst., Bd. 61, 1911 p. 510, pl. 31, fig. 25, may be the young of this species.

The genus *Cylichnella* has been subordinated to *Cylichna* by some authors, to *Tornalina* by others; but it appears to us generically distinct from both, being distinguished from *Cylichna* by characters of the columella and from *Tornatina* by the wholly buried spire.

***Volvula oxytata* Bush**

Volvula cylindrica Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 246. (Not of Carpenter, 1865, or of E. A. Smith, 1871.)

This species was taken rather abundantly. It appears to be quite identical with the recent form.

The type lot of *V. cylindrica* is no. 3179 A. N. S. P.

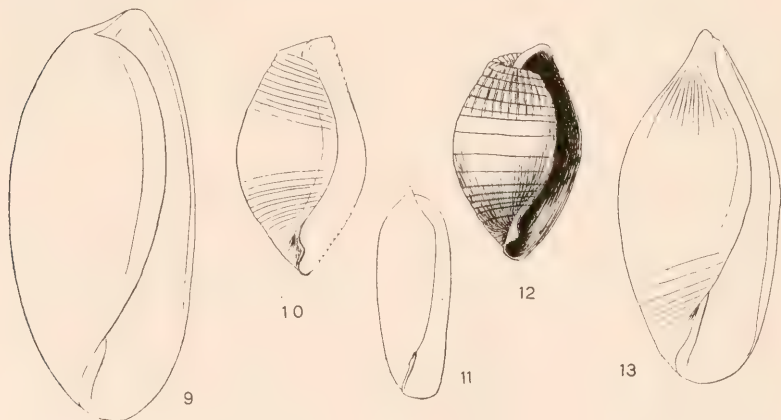


Fig. 9, *Volvula cylichnoides* P. and J. Fig. 10, *Atys cinctorii* P. and J. Fig. 11, *Volvula paralella* P. & J. Fig. 12, *Atys sulcutorum* P. and J. Fig. 13, *Volvula ornata* P. and J.

***Volvula ornata* Pils. and Johns. Text-fig. 13.**

Proc. A. N. S. Phila., 1917, p. 151.

Volvula parallela Pils. and Johns. Text-fig. 11.

Proc. A. N. S. Phila., 1917, p. 151.

Volvula cylichnoides Pils. and Johns. Text-fig. 9.

Proc. A. N. S. Phila., 1917, p. 151.

Cf. Retusa yaquensis Maury, which, however, has spiral sculpture.

SCAPHANDRIDAE.

Atys cinctorii Pils and Johns. Text-fig. 10.

Proc. A. N. S. Phila., 1917, p. 152.

Atys sulcutorum Pils. and Johns. Text-fig. 12.

Proc. A. N. S. Phila. 1917, p. 152.

Atys (Aliculastrum) caribaea (Orb.)

A. caribaea Orb., Pilsbry, Man. Conch. xv, p. 274, pl. 48, fig. 12.

?*A. riiseana* Mörch, Malak. Bl. xxii. p. 173.

A few specimens agree with recent shells which the writer has referred to d'Orbigny's species. *Cf. also Atys gracilis* Dall, from the Chipola horizon.

AKERIDAE.

Haminea granosa (Sowerby)

Bulla granosa Sowerby, Trans. Geol. Soc. Lond. iv, 1849, p. 51, pl. 10, fig. 10.

This species is unusually solid for the genus, and more strongly sculptured than the recent forms.

BULLARIIDAE.

Bullaria solida (Gmel.)

Bulla solida Gmel., Pilsbry, Man. Conch. xv, p. 335.

Several specimens, the largest 40.5 mm. long, 30.5 wide, appear to be referable to this recent species. It has been described as *Bullaria sarahberlinæ* Maury.

Bullaria paupercula (Sowerby)

Bulla paupercula Sowb., Gabb. Tr. Amer. Philos. Soc. xv, p. 246.

Gabb has identified a series of specimens very similar to the recent *B. amygdalus* Dillw., with the imperfectly defined species of Sowerby. Without access to Sowerby's type, the question of specific identity cannot profitably be taken up.

RINGICULIDAE.

Ringicula semilimata Dall.

Ringicula semilimata Dall, Proc. U. S. N. Mus. xviii. 1895, p. 24; Trans. Wagner Inst. Sci. iii, pt. 6, pl. 60, fig. 24.

Ringicula semistriata? Orb., Gabb, Trans. Amer. Philos. Soc. xv, p. 225.
Ringicula dominicana Maury, Bull. Amer. Pal. v, p. 21.

Minute *Ringiculas*, from 1.3 to 1.9 mm. long, are abundant in the Santo Domingo material. In shape and sculpture they show a good deal of diversity—forms like *R. semilimata*, *R. guppyi*, and others; there may be three or four species, as species go in this genus. Without more extended study than we have time for, exact identifications cannot be made. *R. hypograpta* Brn. & Pils., from the Gatun formation, is another similar, but slightly larger, form.

NUCLEOBRANCHIATA.

ATLANTIDAE.

Atlanta rotundata Gabb. Text-fig. 15.

Atlanta rotundata Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 201.

The shell is rather extensively broken. It consists of $5\frac{1}{2}$ whorls the first 4 rather closely wound, with sculpture of four spiral threads on the visible part of the penult whorl. The last whorl shows very minute spiral striation under strong magnification, and there is an inconspicuous groove on each side of the periphery, which shows no trace of a keel. If present it must have been membranous. The diameter, as broken, is 2.5 mm.

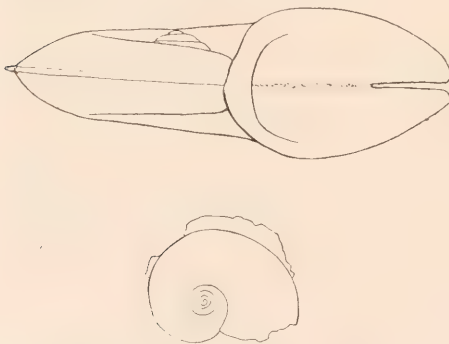


Fig. 14. *Atlanta cordiformis* Gabb.

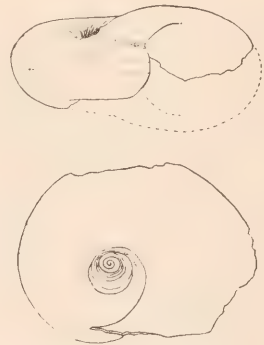


Fig. 15. *Atlanta rotundata* Gabb.

The rounded whorl, without peripheral keel, is similar to that of *Oxygyrus*, but the embryonic shell is that of *Atlanta*. It may form a subgenus of *Atlanta* to be called *Atlantidea*. *Atlanta souleyeti* Smith appears to belong to the same group. It differs from *rotundata* by the more prominent spire. In the figure of the ventral face (fig. 15, above) the spire is concealed behind the lip.

Type no. 2891 A. N. S. P.

Atlanta cordiformis Gabb. Text-fig. 14.

Atlanta cordiformis Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 201.

A very minute species, composed of $4\frac{1}{2}$ whorls, the last carinate and bearing the usual peripheral lamina, which is mainly broken away. The aperture is cordiform, its inner edge in contact with the preceding whorl, not supported on the peripheral lamina. This may be a feature of immaturity. It is a much smaller shell than *A. peronii* having the same number of whorls.

Diameter 1.5, greatest width of aperture 0.55 mm.

Type and two other specimens are no. 2896 A. N. S. P.

Atlanta peronii Leseuer.

Two small specimens, the largest 3.7 mm. in diameter. It is evidently adult, somewhat over half a whorl being in contact with the peripheral lamina only. On account of its small size, the reference to *A. peronii* is made with some doubt, yet in other characters we find no material difference.

PROSOBRANCHIATA.

TEREBRIDAE.

The larger Terebras of Santo Domingo are in some confusion, owing chiefly to the absense of figures of the types of three species described by Sowerby. Guppy¹³ figured "*T. sulcifera* Sowerby," from the Heneken collection, but as he united *sulcifera*, *inequalis* and *bipartita* of Sowerby, we do not know definitely which was figured, nor whether his shell was from the original or the second Heneken collection. The *T. bipartita* of Dall¹⁴ appears to us to be a different species from that of Sowerby.

Gabb's identifications were apparently erroneous. His *T. inaequalis* is *T. haitensis* of Dall,¹⁵ and his *bipartita* is the form we refer to *inaequalis* Sowerby. *T. robusta* Hinds, of Gabb, is *T. gabbi* Dall,

¹³ Quarterly Journ. Geol. Soc. vol. 32. pl. 29, fig.8.

¹⁴ *Terebra* (*Acus*) *bipartita* Sowerby, Dall, Proc. U. S. Nat. Mus. xviii, p. 38, with vars. *spinifera*, *oligomitra*, and *cirrus*, Trans. Wagn. Inst. iii, pl. 59, figs. 13, 28, 29.

¹⁵ *Terebra* (*Hastula*) *haitensis* Dall, Proc. U. S. Nat. Mus. xviii, p. 35. *Terebra* (*Oxymeris*) *bipartita*, etc., Dall, Trans. Wagn. Inst. iii, pl. 59, fig. 30; Potrero, Rio Anima, Santo Domingo.

¹⁶ *Terebra gabbi* Dall, Proc. U. S. N. M. xviii, p. 34; Trans. Wagn. Inst. iii, pl. 59, fig. 31; Portrero, Rio Anima. *T. robusta* Hinds, Gabb, Trans. Amer. Philos. Soc. xv, p. 224.

a form which needs comparison with *T. sulcifera* Sowb. There is a considerable amount of material in the collection, but as Gabb described no new species in this group, we will not enter into the subject further. No revision of any value can be made until Sowerby's types are figured and more fully described.

In addition to the species named above, *Terebra amitra* Dall¹⁷ has been described from the Potrero, Rio Amina.

A very large species of *Terebra*, distinct from all of the above, is represented by one broken and much worn specimen no. 2972. It has slightly over 4 whorls, with a length of 85.5, diam. 26 mm. There are two raised bands around the posterior part of the whorls.

***Terebra gatunensis* Toula.**

Terebra (Oxymeria) gatunensis Toula, Jahrb. K.-K. Geol. Reichsanst., vol. 58, 1909, p. 705, pl. 25, fig. 14.

Terebra gatunensis Toula, Brown and Pilsbry, Proc. A. N. S. Phila. 1911, p. 339, pl. 22, fig. 2.

An abundant species in the Santo Domingo beds. Gabb referred the specimens to *T. dislocata*. About half of them have spiral lines upon the superior band, as in *T. wolfgangi* Toula, but there are more spiral cords below the band than in typical *wolfgangi*.

***Terebra dislocata* Say.**

The series referred to this recent species is highly variable, and a further revision may eventually be made.

There is also a series of small specimens possibly related specifically to *T. protexta* Conr.

***Terebra baculiformis* Pils. and Johns. Plate XXII, figs. 5, 6.**

Proc. A. N. S. Phila. 1917, p. 152.

***Terebra hitia* Pils. and Johns. Plate XXII, fig. 1, 2.**

Proc. A. N. S. Phila. 1917, p. 152.

TURRITIDAE.

***Turris albida* (Perry)**

Pleurotoma albida Perry, Conchology, 1811, pl. 32, fig. 4.

Pleurotoma haitiensis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 50,

Pleurotoma barretti Guppy, Q. J. Geol. Soc., xxii, 1866, p. 290, pl. 17, fig. 6.

Turris (Surcula) virgo Lam. Gabb, Tr. Am. Philos. Soc., xv, p. 206.

Turris albida Perry, Dall, Bull. 90, U. S. Nat. Mus., p. 38.

This well-known species is abundant in the Santo Domingan collection no. 2942.

¹⁷ *Terebra (Acus) amitra* Dall, Proc. U. S. N. Mus. xviii, p. 39. *Terebra (Oxymeris) amitra* Dall, Trans. Wagn. Inst. iii, pl. 59, fig. 19.

Turris rara Gabb. Plate XVII, fig. 1.

Turris (Surcula) rara Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 207.

This is represented by one imperfect specimen. The whorls are flat, sculptured with spiral raised lines, about fifteen between sutures on the penult whorl. There are crowded, sharp and irregular, axial striae. The upper whorls have a slight median angle. The slit-fasciole is not distinctly differentiated on the last two to two-and-a-half whorls, but above that it is slightly prominent and weakly nodose.

Length (broken at both ends) 42.5, diam. 16 mm

Type no. 2941 A. N. S. P.

Surcula jacquensis (Sowerby) Plate XXII, fig. 21, 22.

Pleurotoma jacquensis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 51.

Considered by Gabb to be a synonym of *Drillia henekeni*, but it is a distinct species of *Surcula*. The last whorl has nine or ten large axial ribs which are crossed on the whorls of the spire by six spiral cords, the upper one sometimes accompanied by one or two threads. On the last whorl these cords and threads number about twenty-five, and in many specimens alternate in size, especially towards the anterior end. There is a spiral raised line just below the suture, and the anal fasciole has weak growth-lines or is smooth.

Length 67.3, diam. 26 mm.

Type no. 2939 A. N. S. P.

Surcula longicaudata (Gabb) Plate XVII, fig. 2.

Turris (Surcula) longicaudata Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 208.

This species resembles *Drillia consors* somewhat in form and sculpture, but has the generic characters of *Surcula*. The two apical whorls are smooth, remaining whorls of the spire with large, rounded slightly protractive ribs, which are crossed by six acute, spiral threads, which are a little widened where they cross the ribs. Below the suture, and extending to the angle of the anal fasciole, there is a series of short, slightly retractive riblets. The last whorl is evenly reticulated with axial and spiral ridges, tubercular at their intersections. The interstices are minutely papillose.

Length 26, diam. 7.3 mm.; whorls 10.

Type no. 2938 A. N. S. P.

Surcula humerosa (Gabb) Plate XVII, figs. 4, 5.

Turris (Surcula) humerosa Gabb, Tr. Am. Philos. Soc. xv. 1873, p. 208.

A variable species represented by three specimens, fig. 4 representing the intermediate form. One extreme approaches very close

to *Pleurotoma servata* Conr., from the Vicksburg Oligocene. The chief difference is the greater sinuosity of the growth lines of the body whorl, which run backward both above and below the convex portion of the whorl to near the suture; also in having a more prominent angle at the periphery.

Length of specimen figured 20.5 mm.; a larger specimen, fig. 5, in which the spire is broken, measures 24.5 mm. Another example has the nodes partially obsolete on the last whorl.

Type no. 2940 A. N. S. P. (fig. 4).

Drillia fusiformis (Gabb) Plate XVII, fig. 8.

Defrancia fusiformis Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 209.

Two apical whorls are smooth, the rest having large, rounded, axial ribs crossed by four keel-like ridges on the whorls of the spire, and about twenty on the last whorl, the intervals densely striated spirally. The sinus is deep and strongly contracted in front when the lip is perfect.

Length 36, diam. 11.5 mm.; 12 whorls.

The shell is variable in the length of the anterior canal, but the extremes are connected in the series before us.

Type no. 2937 A. N. S. P.

Drillia henekeni (Sowerby) Plate XVII, fig. 3.

Pleurotoma henikeri Sowerby, Q. J. Geol. Soc., vi, 1849, p. 50, pl. 10, fig. 6.

Turris (Surcula) henekeni Gabb, Tr. Am. Philos. Soc. xv, p. 207.

Not *Drillia henekeni* (Sowerby), Cossmann, Journ. de Conchyl., lxi, 1913, pl. 3, figs. 10, 11.

This shell is well shown in Sowerby's figure. There are many specimens in the Gabb collection, the largest 69 mm. long, 18 wide. No. 2936.

Drillia sororcula Pils. and Johns. Plate XVII, fig. 6.

Proc. A. N. S. Phila. 1917, p. 153.

Drillia subgibbosa Pils. and Johns. Plate XVI, fig. 14

Proc. A. N. S. Phila. 1917, p. 153.

Drillia elocata Pils. and Johns. Plate XVI, fig. 9.

Proc. A. N. S. Phila. 1917, p. 153.

Drillia winchesteræ n. sp. Plate XVI, figs. 7, 8.

Very similar to *D. elocata*, but it is more slender with a longer anterior canal and a deeper posterior sinus, the anal fasciole and the spaces between the spiral ridges being distinctly striate spirally, in each interval about 6 striae. There are seven broad, rounded axial folds on the penult whorl and on the last, weakening on the

anal fasciole. On the face of the last whorl there are 18 narrow, high spiral ridges, a smaller cord above the upper one and a strong, acute cord below the suture. The outer lip is smooth within; inner lip a little raised. The anal sinus is deep, rounded posteriorly, contracted a little anteriorly.

Length (the early whorls lost) 26.5, diam. 8.3 mm.; $6\frac{1}{2}$ whorls remaining.

Type no. 3980 A. N. S. P.

This species was at first considered a slender form of *D. elocata*, but it is clearly distinct. Named for Miss Helen Winchester, who has illustrated this paper.

Drillia consors (Sowerby) Plate, XVI, fig. 3.

Turris (*Drillia*) *militaris* Hinds, Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 207, (not of Hinds, Proc. Zool Soc. 1843; Reeve, Conch. Icon, No. 53.).

Pleurotoma consors Sowb., Q. J. Geol. Soc. vi, 1849, p. 50; Guppy. Q. J. Geol. Soc. 1876, p. 527, pl. 28, fig. 7.

It seems strange that in the absence of specimens of *D. militaris*, Gabb referred *D. consors* to that recent species.

A specimen of *D. consors*, 41.6 mm. long, 12 wide, has 23 axial ribs on the last whorl, and about 18 spiral cords. A strong presutural keel revolves above the anal fasciole.

It is an abundant shell. No. 2935.

Drillia macilenta rectaxis n. subsp. Plate XVI, figs. 1, 2.

Cf. *Drillia alesidota* Dall, var. *macilenta* Dall, Rep. Blake Gastrop., in Bull. Mus. Comp. Zool. xviii, 1889, p. 85, pl. 36, fig. 1.

Judging by the description and figure, this is very near *D. alesidota macilenta* Dall, but it differs by the columellar lip, which is straight to the base, and by the narrower aperture.

Length 44, diam. 10.5 mm.

Type no. 2934 A. N. S. P.; 17 other specimens.

Drillia gatunensis alia n. subsp. Plate XVII, fig. 7.

Closely related to *D. gatunensis* Toulou, but it differs by having the spiral grooves simple throughout, not occupied by minor spirals on the base; the vertical ribs do not retract strongly above the shoulder as they do in *D. gatunensis*, in which the growth lines are much more deeply sinuated at the anal fasciole.

Length 31, diam. 10.5 mm.

Length 41 mm.

Type no. 2919 A. N. S. P.

Drillia venusta (Sowerby) Plate XVII, fig. 14.

Pleurotoma venusta Sowerby, Q. J. Geol. Soc. vi, 1849, p. 50, pl. 10, fig. 6.

This species has been well figured by Sowerby and is represented by many examples in the Gabb collection (no. 2931). It has no direct relationship with *D. jamaicensis* Guppy, which has been united with it (Proc. U. S. N. Mus. vol. 19, 1896, p. 305). They are conspicuously diverse in sculpture, form and size, in large series of both we have examined. *D. venusta* attains a length of over 45 mm., while 19 mm. is about the maximum size of *jamaicensis*.

Drillia jamaicensis (Guppy)

Pleurotoma jamaicensis Guppy, Q. J. Geol. Soc. xxii, 1866, p. 290, pl. 16, fig. 6.

Drillia ebenina Dall, Trans. Wagn. Free Inst. Sci. iii, pt. 1, 1890, p. 33, pl. 2, fig. 8.

Dr. Dall says of his *D. ebenina*, "Miocene of Santo Domingo (Gabb); Pliocene of the Caloosahatchie beds. Recent on the shores of the Gulf of Mexico from Florida to Vera Cruz." And after the description, "This fine species was first found living in shallow water on the Florida Keys by H. Hemphill. I find specimens of it together with several other species confused together under the name of *jamaicense* Guppy in the Gabb collection at Philadelphia." Some error is involved in these statements, as there is no such shell in the Gabb collection, and Gabb makes no reference to "*jamaicensis*" in his work. There are specimens of *Pleurotoma jamaicense* Guppy, from Jamaica, in the collection of the Academy, obtained from Mr. Vendryes and from other sources. These agree well with Dr. Dall's description and figure of *D. ebenina*, and with specimens from the Caloosahatchie Pliocene.

While this species may occur in Santo Domingo, we have at present no evidence that it does.

Drillia squamosa (Gabb) Plate XVI, figs. 4, 5.

T. (Drillia) squamosa Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 208.

Pleurotoma squamosa Gabb, Guppy, Q. J. Geol. Soc. 1876, p. 527, pl. 29, fig. 7.

The whorls bear stout oblong, peripheral nodes, about 9 on the penult, each over-ridden by an acute protractive raised line which is a former free lip-edge. There is a strong varix a short distance behind the lip. The whole surface has a fine sculpture of irregular, interrupted, crimped spiral threads, the intervals densely and much more minutely crossed by raised growth striae. The outer lip is broken in all of the specimen.

Length 56.5, diam. 23 mm., with 8 whorls remaining, the early ones lost.

Length 59. diam. 22.3 mm., with $9\frac{1}{2}$ whorls remaining (type).

Type no. 2922 A. N. S. P.

A paratype is figured, since the type, while larger, has the aperture more broken. The dimensions given by Gabb were merely approximate. He seems rarely to have actually measured his specimens.

Drillia callistura Pil. and Johns. Plate XVI, fig. 12.

Proc. A. N. S. Phila., 1917, p. 154.

Drillia ischnatracta Pils. and Johns. Plate XVI, fig. 15.

Proc. A. N. S. Phila., 1917, p. 154.

Drillia scala Pils. and Johns. Plate XVI, figs 16, 17.

Proc. A. N. S. Phila., 1917, p. 155.

Drillia hexapleura Pils. and Johns. Plate XVIII, fig. 1.

Proc. A. N. S. Phila., 1917, p. 155.

Drillia mimula Pils. and Johns. Plate XVI, fig. 13.

Proc. A. N. S. Phila., 1917, p. 155.

Drillia esculenta Pils. and Johns. Plate XVI, fig. 18.

Proc. A. N. S. Phila., 1917, p. 156.

Drillia orthopleura Pils. and Johns. Plate XVI, fig. 19.

Proc. A. N. S. Phila., 1917, p. 156.

Drillia callistopleura Pils. and Johns. Plate XVI, fig. 6.

Proc. A. N. S. Phila., 1917, p. 157.

Drillia lissotropis dorsuosa Pils. and Johns. Plate XVIII, fig. 5.

Proc. A. N. S. Phila., 1917, p. 157.

Type no. 2959 A. N. S. P.

Drillia foveolata Pils. and Johns. Plate XVI, fig. 20.

Proc. A. N. S. Phila., 1917, p. 157.

Drillia parkeri (Gabb) Plate XVI, fig. 21.

T. (Drillia) parkeri Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 207.

A much lengthened, fusiform shell, with plain, subacute axial ribs, and protractive growth-lines, which are strongly arcuate at the posterior part. Eleven ribs are on the penult whorl. $2\frac{1}{2}$ apical whorls are smooth and convex. There is no spiral striation except towards the end of the anterior part. The aperture is broken in both examples.

Length 26.8, greatest diam. 7 mm., $11\frac{1}{2}$ whorls.

Type and another specimen are no. 2924 A. N. S. P.

Mangilia dominicensis (Gabb) Plate XXXV, fig. 1.

T. (Bela) dominicensis Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 208.

The type specimen has about 13 axial ribs on the last whorl. Under sufficient magnification it shows close spiral lines of granules, every fourth line slightly larger. On the spire the whorls are strongly angular in the middle, but this angle weakens a good deal on the last whorl.

Length 5.5, diam. 1.75 mm., with $8\frac{1}{2}$ whorls, having lost one or two.

A young specimen in the lot shows $2\frac{3}{4}$ convex whorls forming the conic embryonic shell; these seem to be microscopically punctate. They are followed by $\frac{3}{4}$ of a whorl (nepionic) which is closely sculptured with protractive riblets.

Cythara heptagona (Gabb) Plate XVII, fig. 9.

Mangilia heptagona Gabb, Trans. Amer. Philos. Soc. xv, p. 211,

Cythara terminula Dall, Trans. Wagner Free Inst. Sci. III, pt. 1, 1889 p. 38, Pl. 2, fig. 5.

After $1\frac{1}{2}$ rounded apical whorls, there is a half whorl having numerous ribs. On subsequent whorls there are seven narrow, acute axial ribs, continuous from whorl to whorl. Fine, but clearly engraved spiral lines run over ribs and the broad concave valleys. The outer lip has a longitudinal callus inside below the posterior sinus.

Length 15, diam. 6.5 mm., 8 whorls.

The type and another specimen are no. 2915 A. N. S. P.

Specimens from the Pliocene of the Caloosahatchie River and Shell Creek seem to be specifically identical. They have 7, 8 or 9 longitudinal ribs.

Cythara polygona (Gabb) Plate XVII, fig. 10.

Mangilia polygona Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 211.

The first 2 whorls are convex and smooth, the following half whorl multicostate. Following whorls are subangular below the middle, the angulation decreasing gradually to the penult, which is rounded. Last whorl has 15 narrow axial ribs. Spiral striation is fine and close.

Length 11, diam. 4.4 mm., $7\frac{1}{2}$ whorls (type, no. 2916 A. N. S. P.).

Other specimens of the type lot show varying numbers of ribs, from 11 to 18 on the last whorl. When numerous, the ribs are not continuous from whorl to whorl throughout. Another specimen is labelled Cibao Valley.

C. gibba Guppy, from the Oligocene of Jamaica (Proc. U. S. Nat.

Mus., XIX, 1896, p. 306, pl. 27, fig. 9.), seems to resemble closely the young of this species.

Cythara elongata (Gabb) Plate XVIII, fig. 6.

Mangelia elongata Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 211; Journ. Acad. Nat. Sci. Phila. 2 Ser., viii, 1881, p. 351, pl. 46, fig. 31,

This species has 6 ribs, continuous from whorl to whorl. There is a group of faint spiral striae in the region of the anal fasciole, but none elsewhere on the last whorl. Gabb's figure is bad, the last whorl being represented as far too convex.

Length 7, diam. 2.3 mm.

The single specimen is no. 2917 A. N. S. P.

Cythara elevata (Gabb) Plate XVIII, fig. 3.

Mangelia elevata Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 211.

This small species has $6\frac{1}{2}$ whorls, of which the first 3 comprise the embryonic shell. These whorls are smooth and convex until the last half-whorl, which has close, fine backwardly arched riblets. Subsequent whorls have slightly protractive rounded ribs, eleven on the penult whorl, rather high, and compressed below the sutures; in the lower half of each whorl crossed by three spiral threads, in the intervals of which there are about three very low spirals. On the last whorl there are about 20 major spirals; they are closer anteriorly, where there are fewer of the low minor spirals, there being four in the upper intervals, down to one in the lower. The aperture is of nearly the same width throughout. Anal sinus rounded.

Length 6.3, diam. 2.5 mm.; 7 whorls.

Type is no. 3224 A. N. S. P. A single specimen.

Clathurella paupercula (Gabb) Plate XVIII, fig. 4.

Defrancia paupercula Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 209.

The sculpture is of close, small vertical folds which curve backward close below the suture, crossed by numerous spiral cords, 7 on the penult whorl below the fasciole, one cord above it. The anal sinus is oblique and moderately deep. Lip arches forward, and is strengthened by a rather strong, rounded varix.

Length 8.5, diam. 3.3 mm., about $4\frac{1}{2}$ whorls remain.

Type no. 2918 A. N. S. P.

Clathurella gracilis (Gabb) Plate XVI, fig. 10, 11.

Defrancia gracilis Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 209.

On the penult whorl there are sixteen axial ribs, crossed by five or six narrow spiral cords; on the last whorl about eighteen narrow, spiral cords, which are slightly enlarged where they cross the ribs

and widely spaced in the peripheral region and above. Between them are many minute spirals and rather sharp axial striae (Plate XVI, fig. 11).

Length 28.5, diam. 7.5 mm., aperture 12.5 mm. long; 10 whorls (not 11 as stated by Gabb).

The type is no. 2914 A. N. S. P.

Clathurella amica Pils. and Johns. Plate XVII, fig. 13.

Proc. A. N. S. Phila., 1917, p. 158.

Glyphostoma dentiferum (Gabb) Plate XVII, fig. 15.

Glyphostoma dentifera Gabb, Proc. A., N. Sci. 1872, p. 971 [=271], pl. 11 fig. 4. (Feb. 11, 1873). Tr. Am. Philos. Soc. xv, 1873, p. 210.

Clathurella (Glyphostoma) dentifera (Hinds), Cossmann, Journ. de Conchyl. xi, 1913, p. 31, pl. 2, figs. 15-17, with var. *martinicensis* Cossm., figs 18-20.

Gabb's figure is not very good. The whorls of the spire have stout, short ribs or nodes at the periphery. On the penult whorl they become smaller and bifurcate below the shoulder, and the last whorl has numerous narrow ribs, part of them uniting by pairs at the shoulder. In the series of 9 individuals, there is very great variation in size and shape. It is possible that with further large series, an assortment into several species would be practicable, though this seems unlikely. The smallest one having a complete adult aperture is 14.5 mm. long, of 9 whorls. Others measure:

Length 32.4, diam. 13 mm.; $9\frac{1}{2}$ whorls (type).

Length 31 (estimated), diam. 10 mm.

Length 26.4, diam. 10 mm.; $10\frac{1}{2}$ whorls.

This is type of the genus *Glyphostoma*. It is certainly distinct from the recent *Clavatula dentifera* Hinds, but if that species is a *Glyphostoma*, as seems likely, the name *dentiferum* Gabb will have to be changed. Perhaps *martinicensis* Cossmann will be available; but the figures are imperfect and I am not sure that the forms are specifically identical.

Clavatula labiata Gabb. Plate XVII, figs. 11, 12.

Clavatula labiata Gabb, Trans. Amer. Phil. Soc. xv. 1873, p. 209. Guppy, Quart. Journ. Geol. Soc. 1876, p. 527, pl. 28, fig. 3.

This species has a mamillar embryonic shell of $1\frac{3}{4}$ whorls, the first rounded and very bulbous, though small, the last third of the last embryonic whorl becoming angular in the middle. After that the neanic sculpture appears abruptly, strong, protractive peripheral nodes crossed by fine, sharp, spiral threads. On the last whorl the spirals are hardly noticeable except near the base. The crenulations within the outer lip are short and sharp.

Length 20.5, diam. 9.9 mm.

The type is the largest of six specimens catalogued under no. 2928 A. N. S. P.

Scobinella magnifica (Gabb) Plate XVII, fig. 16.

Cordia magnifica Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 210.

This beautiful species is much larger and more slender than *S. caelata* Conrad, of the Vicksburg Oligocene, which it resembles in sculpture. The columella has four plaits, which diminish downward from the upper one, as in *Mitra*.

Length 70.5, diam. 16.4, length of aperture 34.7 mm.; 12 whorls, those of the embryonic shell being lost.

Type is no. 2926 A. N. S. P.

A *Scobinella* has been described from Mindi, Canal Zone, under the name *Euchilodon morierei* Laville MS., by M. Cossmann.¹⁸ It has a shorter anterior canal than either of the Santo Domingan species, and differs in some details of sculpture, but it evidently stands close to *S. tristis*. These species cannot belong to the genus *Euchelodon*, which differs conspicuously by having a numerous series of ten or twelve short subequal transverse folds on the collumella, somewhat as in some Columbellas. In *Scobinella* the structure is like *Mitra*.

Scobinella tristis Pils. & Johns. Pl. XVII, figs. 17, 18.

Proc. A. N. S. Phila. 1917, p. 158.

Borsonia (Paraborsonia) varicosa (Sowerby) Plate XVII, figs. 19, 20, 21.

Mitra varicosa Sowerby, Q. J. Geol. Soc. vi, 1849, p. 46.

Cordia varicosa Sby., Gabb, Trans. Amer. Philos. Soc. xv. p. 210.

A handsome, very elaborately sculptured species. The anal fasciole forms a strongly elevated band at the shoulder. This band is bilirate, the two cords tuberculate, the tuberles being connected across the interval. Below the shoulder there is a close sculpture of larger alternating with smaller spiral cords and threads crossed by close but very much interrupted axial threads, the intersections graniferous. Near the anterior end the axial sculpture disappears. Above the shoulder there are crowded, granose spirals. The rather small anal sinus is continued inward as a furrow. Below it are many sharp lirae within the lip. The columella has two strong plaits, the upper one larger and flat-topped. The lower plait is about midway between the ends of the inner margin. In half-grown individuals there is a third distinct plait, and in one the weak

¹⁸ Journ. de Conchyl., LXI, 1913, p. 34, pl. 3, figs. 6, 7.

trace of a fourth may be seen. A complete shell should have about 9 whorls.

The embryonic shell consists of $1\frac{1}{2}$ smooth convex whorls, the summit a little obtuse.

Length 24, diam. 9.1, length of aperture 13 mm.

This species differs from *Borsonia*, as defined by M. Cossmann, by the large upper plait high on the columella, and the sinus at the shoulder, terminating an elevated anal fasciole; the sculpture otherwise much as in *Scobinella*. We propose for it the new subgenus *Paraborsonia*.

Rouaultia has the sinus in the same situation, but it differs widely in other characters.

Borsonia recurvirostris Gabb. Plate XVIII, fig. 2.

Borsonia recurvirostris Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 210.

There are fourteen nodes on the periphery of the last whorl, below which are numerous, strongly unequal spiral cords and threads. On the whorls of the spire only three spirals are visible, the upper one being peripheral. Between the concave anal fasciole and the suture there is a prominent spiral ridge. The single columellar plait is strong and but little oblique.

Length 9.6, diam. 3.9 mm.; $8\frac{1}{3}$ whorls.

It probably belongs to the subgenus *Borsonella* Dall, though the sculpture is rather diverse.

The type is no. 2912 A. N. S. P.

CONIDAE.

Conus haytensis Sowerby. Plate XIX, fig. 1.

Conus haytensis Sowb., Quart. Journ. Geol. Soc. vi. 1849, p. 44.

Conus haytensis Sowb., Gabb, Tr. Amer. Philos. Soc. xv, 1872, p. 231 (in part).

The largest species of the genus in the Santo Domingan formation. The spire is conspicuously striated spirally; also the anterior part of the last whorl. These striae are not granulous. The base is less contracted than in *C. domingensis*.

Length 107, diam. 65 mm. (Fig. 1).

Length 91, diam. 55 mm.

Length 85, diam. 58 mm.

In some specimens the spire is very low or almost flat except for a central mucro.

Length 61.5, diam. 44 mm.

Length 54, diam. 32.5 mm.

Conus haytensis politispira n. subsp. Plate XIX, fig. 5.

Spiral striae on the spire are very faint or wanting, the surface being somewhat polished. It does not attain so large a size as the typical form.

Length 66, diam. 35 mm.

Type no. 2565 A. N. S. P.

Conus domingensis Sowerby. Plate XIX, fig. 7.

Conus domingensis Sowb., Q. J. Geol. Soc. vi, 1849, p. 45.

This was included by Gabb in *C. haytensis*, but it may be distinguished by the pyriform contour, distinctly contracted near the anterior end, and the usually more acute spire. Four or five of the upper whorls are conspicuously nodose. The spirals of the anterior half are more or less granulous. On comparing a good series of different ages with *C. symmetricus* we consider them quite distinct species.

Length 89.5, diam. 49 mm.

While abundant, it was not taken in such copious quantity as *C. haytensis*.

Conus recognitus Guppy. Plate XIX, fig. 2.

Conus solidus Sowerby, Quart. Journ. Geol. Soc. xv, 1849, p. 45. Guppy, Q. J. Geol. Soc. xxii, 1866, pl. 16, fig. 1. Not *C. solidus* Sowb., Thes. Conch. 1841, p. 580.

Conus pyriformis Reeve, Gabb, Tr. Amer. Philos. Soc. xv, 1872, p. 229. Not of Reeve, Conch. Icon. fig. 70.

Conus recognitus Guppy, Proc. Sci. Asso. Trinidad, 1867, p. 171; Geol. Mag. 1874, p. 409; Q. J. Geol. Soc. 1876, p. 527.

This species is undoubtedly close to the recent *C. pyriformis* Reeve from the west coast of Central America, which is probably a descendant. *C. recognitus* is quite readily distinguished by the small nodes on the spiral whorls being obsolete, or present only on three or four of the upper whorls, while in *C. pyriformis* they are prominent on at least seven. It is also less pyriform.

Length 70, diam. 41 mm.

Conus imitator Brown and Pilsbry.

Conus imitator B. and P., Proc. A. N. S. Phila. 1911, p. 342, pl. 23, fig. 2, 3.

The largest specimen of a series collected by Gabb is 67 mm. long. The shoulder of the last whorl is acutely angular in the adult stage, and the spire is lower than in *C. catenatus*. It is related to *C. planiliratus*, but is larger and smoother, and not contracted near the anterior end.

Conus stenostoma Sowerby. Plate XXI, fig. 1.

Conus stenostoma Sowb., Quart. Journ. Geol. Soc. Soc. xv, 1849, p. 44.

Conus stenostoma Sowb., Guppy, Quart. Journ. Geol. Soc. xxii, pl. 16, fig. 2.

Mr. Guppy's otherwise good figure does not show the marked retraction of the lines of growth at the shoulder, which is one of the important characters of *C. stenostoma*.

Length 74, diam. 40 mm.; a larger, imperfect shell has a diameter of 43 mm.

Conus furvoides Gabb. Plate XX, fig. 1.

Conus furvoides Gabb. Tr. Amer. Philos. Soc. xv, 1873, p. 232.

A narrow species, having a prominent ridge projecting above the suture of the last 4 whorls. Spiral striae on the spire are wanting or very faint. There are a few weak spirals towards the base.

Length 51.5, diam. 24.5 mm.

Length 44.5, diam. 22.7 mm. Fig. 1. Type.

The type and eleven other specimens are included in no. 3576 A. N. S. P.

Conus furvoides brachys Pils. and Johns. Plate XX, fig. 3.

Proc. A. N. S. Phila., 1917, p. 158.

Conus catenatus Sowerby. Plate XXII, figs. 3, 4.

Conus catenatus Sby., Q. J. Soc. xv, 1849, p. 45, pl. 9, fig. 2.

Conus interstinctus Guppy, Q. J. Geol. Soc. xxii, 1866, p. 288, pl. 16, fig. 3.

This was originally described and figured from a very young example. It attains the size and has the form of *C. consobrinus*, but differs by lacking tubercles on the spire. The upper whorls have a smooth, sharp carina projecting above the sutures, becoming blunt on the last 2 or 3 whorls in adults. Above the angle there are very fine spiral striae. Lower half or more of the last whorl is spirally striate, some of the spirals bearing granules. Young shells have more granulose spirals, as usual in this genus.

Length 65, diam. 29. mm. Fig. 3.

Length 48, diam. 23.5 mm.

Length 28, diam. 13 mm. Young. Fig. 4.

Conus xenicus Pils. and Johns. Plate XX, figs. 11, 11a.

Proc. A. N. S. Phila., 1917, p. 159.

Conus symmetricus Sowerby. Plate XX, figs. 2, 2a, 2b.

Conus symmetricus Sowb., Q. J. Geol. Soc. VI., 1849, p. 44, pl. 9, fig. 1.

The spire is striate, as in *C. haytensis* but the early whorls are not nodose above the suture. The granulation occupies from one-third to the whole of the last whorl. Ordinarily there are several nearly smooth, smaller spiral threads between the beaded spirals, but in some examples these secondary threads are as large as the

primaries, and nearly all are beaded. The very large series also comprises specimens transitional in sculpture.

It is much smaller than *C. haytensis*, the maximum size seen having a length of 48.5, diam. 28.5 mm.

There is a different *Conus symmetricus* of Deshayes, Deser. Anim. s. Vert. Bassin Paris iii, 1866, p. 426, pl. 100, figs. 27, 28.

C. s. var. *semiobsoletus* Maury is not separable from *symmetricus*, being merely the mature stage. This is demonstrated by the very large series in the Gabb collection.

Conus aratus Gabb. Plate XX, fig. 4.

Conus aratus Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 232.

Conus ornatus Gabb, Maury, Bull. Amer. Pal. v, p. 41.

This species resembles *C. haytensis* somewhat in form, but differs by having conspicuous, widely spaced spiral grooves on the lower two-thirds of the last whorl. These grooves are very sharply cut in half-grown shells; in the largest example some of them are a little less deeply cut. There are about 12 widely spaced grooves and an equal number of close ones near the anterior end. The spire has close and rather deep spiral striae, 4 or 5 on each whorl. The inner whorls are inconspicuously tuberculate above the suture. The growth-lines retract strongly at the shoulder, as in *C. stenostoma*, which is allied.

Length 63, diam. 34 mm. Type.

Length 38, diam. 23.5 mm. Immature.

Type and 7 others are no. 2572 A. N. S. P.

C. ornatus Gabb of Maury is the half grown stage of *C. aratus*.

Conus planiliratus Sowerby. Plate XX, figs. 6, 9.

Conus planiliratus Sowerby, Q. J. Geol. Soc. vi, 1849, p. 44. Guppy, Q. J. Geol. Soc., xxii, 1866, p. 287, pl. 16, fig. 7.

Conus regularis Sby., Gabb, Journ. A. N. S. Phila., viii, p. 359, pl. 46, figs. 45-48. Not of Sowerby.

Gabb misunderstood this species. What he called *C. planiliratus* is an undescribed species which will be called *C. perlepidus*.

C. planiliratus is an extremely variable shell in sculpture of the last whorl, but the shape and the sculpture of the spire are quite constant. In large specimens the spirals are weak on the upper half of the last whorl (fig. 9).

Length 42, diam. 21 mm. or smaller.

We agree with Guppy's determination of this species. He has figured a Jamaican specimen.

For *Conus planiliratus* G. B. Sowerby, Jr., Proc. Zool. Soc. Lond.

1870, p. 255, pl. 22, fig. 1, we propose the name *Conus maculospira* Pils. & Johns.

Conus perlepidus Pils. and Johns. Plate XX, fig. 5.

Proc. A. N. S. Phila., 1917, p. 159.

Conus consobrinus Sowerby. Plate XX, figs. 7, 7a, 7b.

Conus consobrinus Sowb. Q. J. Geol. Soc. vi, 1849, p. 45.

The high, straightly conic spire with coronated whorls is distinctive. In large specimens from one to two or rarely three latest whorls are without nodes. Spiral sculpture of the last whorl is variable and in adults generally restricted to the lower half. In some young specimens the last whorl is covered with spiral threads, partly granose. The posterior sinus of the aperture is very deep.

Length 56, diam. 25 mm.

Length 50, diam. 22.5 mm.

There is a large series of various ages in the Gabb collection. Also found in the Bowden formation, and in a modified form it existed into the Pliocene.

Conus consobrinus ultimus Pils. and Johns. Plate XX, fig. 8.

Proc. A. N. S. Phila., 1917, p. 160.

Pliocene of Costa Rica.

Conus gaza Johnson and Pilsbry.

Conus marginatus G. B. Sowerby, Quart. Journ. Geol. Soc. vi, 1849, p. 44. Guppy, Quart. Journ. Geol. Soc. xxxii, 1876, p. 528, pl. 29, fig. 5. Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 230. Not *Conus marginatus* J. de C. Sowerby, 1837.

Conus gaza J. and P. in Brown and Pilsbry, Proc. A. N. S. Phila. 1911, p. 342, pl. 23, figs. 2, 3.

The figured type and 8 other specimens are no. 2554 A. N. S. P.

Conus marginatus Sowerby, of Cossmann, Journal de Conchyliologie 1913, p. 44, pl. 3, figs 14, 15, is evidently another species. It may be called *Conus pseudomarginatus*.

Conus trisculptus Pils. and Johns. Plate XIX, fig. 6.

Proc. A. N. S. Phila., 1917 p. 160.

Conus longitudinalis Pils. and Johns. Plate XIX, fig. 4.

Proc. A. N. S. Phila., 1917, p. 160.

Conus strombiformis Gabb. Plate XXI, fig. 2.

Conus strombiformis Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 232.

The upper part of the spire is regular, but the penultimate whorl, at its last third, begins to descend more rapidly, this continuing in the last whorl. The earliest whorls are worn, but the intermediate ones have low and obtuse but strong nodes, and no spiral striation.

The nodes become weaker on the penult whorl and almost disappear on the last. The last two whorls have the periphery unusually rounded for a *Conus*. There are about 9 coarse spiral cords near the anterior end.

Length 63, diam. 35.5 mm. Probably about 12 whorls.

Type no. 2571 A. N. S. P. A single example.

This shell has a rather abnormal appearance, but the sculpture of the spire is unlike other known cones of the same beds.

Conus yaquensis Gabb. Plate XXI, fig. 6.

Conus yaquensis Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 233.

This cone resembles *C. proteus* closely in shape except that the spire is lower, with much less concave outlines, the apical angle much wider. The spiral furrow below the suture is deeper. In color it is a "negative" of *C. proteus*, the spots being white, the intervals ferruginous. This color affects the texture of the shell, the white spots resisting erosion. In one worn specimen there are spiral series of pits along the colored bands. The anterior third of the last whorl has a few narrow raised spirals.

Length 49, diam. 30 mm. Type.

Length 40, diam. 23 mm. Paratype.

The two specimens are no. 2547 A. N. S. P.

Conus mus Hwass.

Conus mus Hwass, Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 230.

Two specimens are catalogued under no. 2562 A. N. S. P.

Conus bonaczyi Gabb. Plate XIX, fig. 3.

Conus bonaczyi Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 233.

This small species has the whorls of the spire flattened, very slightly concave, and marked with arcuate radial striae only. Shoulder rounded; lateral outline convex except near the base, where it is contracted. There are 18 spiral riblets, much wider than the intervening grooves in the upper part, about equal to them in the lower. The riblets are slightly concave on top. The grooves have fine, close, sharp axial striae.

Length 21.5, diam. 12 mm.

Type no. 2551 A. N. S. P.

A specimen 15.3 mm. long has 20 spiral riblets, which are narrower than in the type.

Conus proteus Hwass.

The specimens agree well with recent shells in form and markings.

Conus proteus humerosus n. subsp. Plate XXI, fig. 4.

Some specimens in the lot of *proteus* have fewer spots, as noted by Gabb. In the one figured there are 6 spiral rows of spots on narrower continuous bands. In another there seem to be 7 such spotted bands, but the color is nearly obliterated. Both of these shells are very broad-shouldered; otherwise they agree with *C. proteus*.

Length 65 (apical whorls lost), diam. 45 mm. (Type, no. 2548).

Length 64, diam. 40.5 mm.

This cone agrees with *C. williamgabbi* Maury in general shape and dimensions, but the whorls of the spire are concave, without spiral threads, and there are no spirals in the lower part of the shell.

Conus simplicissimus Pils. and Johns. Plate XXI, fig. 3, 5.

Proc. A. N. S. Phila., 1917, p. 161.

Conus cercadensis Maury (*porcellus* Pils. and Johns.). Plate XX, fig. 10.

Proc. A. N. S. Phila., 1917, p. 161.

This is apparently synonymous with *C. cercadensis* Maury.

Conus pernodosus Pils. and Johns. Plate XXI, fig. 7.

Proc. A. N. S. Phila., 1917, p. 162.

Conus gabbi Pils. and Johns. Plate XXI, fig. 8, 9.

Conus gabbi Proc. A. N. S. Phila., 1917, p. 162.

Conus gracilissimus Guppy, Maury, Bull. Amer. Pal. v, p. 40.

In Bowden specimens of *Conus gracilissimus* the spiral cords are flattened and slightly wider than their intervals. In *C. gabbi* they are much narrower than the intervals and not at all flattened. This is not a matter of age. We have not seen the Bowden species from Santo Domingo.

Conus larvatus Pils. and Johns. Plate XXI, fig. 10.

Proc. A. N. S. Phila., 1917, p. 163.

CANCELLARIIDAE.

Cancellaria barretti Guppy.

Cancellaria reticulata Gabb, Tr. Am. Philos. Soc. xv, p. 236. Not of Linné.

Cancellaria barretti Guppy, Quart. Journ. Geol. Soc. xxii, 1866, p. 289, pl. 17, fig. 11.

While this species doubtless was the ancestral form of the recent *C. reticulata* (L.), it differs in several minor characters. The shell is thinner and the whorls of the spire are slightly more convex, giving the spire a less attenuated appearance; the reticulations are

much finer and more regular, while the varices are more prominent; the columellar plaits are smaller, the large upper one is thin and acute, showing no trace of bifurcation.

Cancellaria guppyi Gabb. Plate XXII, fig. 7.

Cancellaria guppyi Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 236.

Similar to *C. barretti* in sculpture, but smaller and much thicker, the whorls more ventricose, the suture deep, narrowly channeled; plaits of the columella prominent, the large upper one bluntly bifid.

Length of the type figured 28, diam. 18.4 mm.

The type and seven other specimens are no. 2990 A. N. S. P.

Cancellaria rowelli Dall.

Cancellaria rowelli Dall, Proc. U. S. Nat. Mus. xix, 1896, p. 307, pl. 29, fig. 1.

Many specimens of this species were found associated with *C. barretti*. "It is perhaps most nearly related to *C. urceolata* Hinds, found living on the west coast of Middle America".

Cossmann's figures, Journ. de Conch. LXI, 1913, p. 53, pl. 4, fig. 5, 6, are probably not this species.

Cancellaria epistomifera Guppy. Plate XXII, fig. 13.

Cancellaria moorei Gabb, Tr. Am. Philos. Soc. xv, p. 236. Not of Guppy.

Cancellaria epistomifera Guppy, Quart. Journ. Geol. Soc., xxxii, 1876, p. 520, pl. 28, fig. 9.

Gabb erroneously referred this to *C. moorei* Guppy, a common species in the Bowden beds. A specimen is figured for comparison with *C. gabbiana*.

Cancellaria laevescens Guppy.

Cancellaria laevescens Guppy, Quart. Journ. Geol. Soc. xxii, 1866, p. 289, pl. 17, fig. 12.

This species resembles somewhat the recent *C. obesa* Sowb., from the west coast of Central America. The Santo Domingo specimens are a small, finely sculptured form of the species, length 28, diam. 17.8 mm.

Cancellaria ellipsis n. sp. Plate XXII, figs. 8, 9.

Cancellaria tessellata Sowerby, Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 236. Not of Sowerby.

The shell is small, oblong, with conic spire of nearly 6 whorls, of which the apparently smooth embryonic shell comprises $1\frac{1}{2}$. Subsequent whorls have an even cancellate sculpture of equally prominent axial riblets which are distinctly narrower than their intervals, and spiral cords equal to their interstices, the intersections raised. On the last whorl there are 24 spirals. The aperture is

somewhat oblique, narrow; outer lip obtuse, evenly arcuate, with marginal crenulations corresponding to external spirals, and a much smaller number of lirae (12) extending further within. The columella has two strong plaits and further out there are several oblong tubercles on its face. A thin callus spreads a short distance forward over the ventral face.

Length 12, diam. 6.7 mm.

Type and a second specimen no. 2909 A. N. S. P. Both are figured.

C. tessellata Sowerby, besides being a much larger shell, differs by the copious callous deposit which spreads over most of the ventral face of the last whorl, and the embryonic shell is larger. A specimen 27.3 mm. long has nearly 7 whorls, of which about $2\frac{3}{4}$ belong to the embryonic stage.

Possibly this is a younger stage of *C. islacolonis* Maury, which has a more developed lip and a widely spreading callus in front. The two examples however appear to be adult.

Cancellaria gabbiana Pils. and Johns. Plate XXII, fig. 12.

Proc. A. N. S. Phila., 1917, p. 163.

The last whorl is shorter and the aperture broader than in *C. epistomifera*. There is a trace of the characteristic spout of the lip, but much less marked than in that abundant species. The axial ribs are fewer, more widely and less regularly spaced in *gabbiana*.

Cancellaria (Trigonostoma) insularis Pils. and Johns. Plate XXII, fig. 11.

Proc. A. N. S. Phila., 1917, p. 163.

After the $1\frac{1}{2}$ smooth embryonic whorls the sculpture begins abruptly; there are about 14 retractive ribs on the first neanic whorl, crossed by about 7 very much finer, spiral threads. The last whorl has two somewhat enlarged ribs or varices next behind the lip, and one but slightly prominent on the left side of the ventral face. There are no varices on the earlier whorls. The spiral sculpture of the last whorl is far less coarse than in *C. gurabis* Maury. There are no spirals in the sutural excavation.

While evidently related to *C. gurabis*, this differs in so many details that with present materials it appears to be distinct.

OLIVIDAE.

Oliva reticularis Lam.

The specimens which we refer to typical *O. reticularis* are readily separated from *O. cylindrica*, in the large series at hand.

Oliva cylindrica Sowerby. Plate XXIII, figs. 2, 3.

Oliva cylindrica Sowerby, Q. J. Geol. Soc. vi, 1849, p. 45.

Oliva giraudi Cossmann, Journ. de Conchyl., lxi, 1913, p. 56, pl. 5, figs. 1, 6-8 (Martinique), figs. 4, 5, (Saint-Domingue.)

This abundant Olive is distinguishable from *O. reticularis* by the wider, more cylindric form, the lower spire composed of flat (not concave) whorls. The shape is much more like *Oliva splendidula* Sowb., of the west coast of Central America.

There is the usual variation in height of the spire and degree of concavity of its outlines, such as occurs in most species of *Oliva*.

Length 52, diam. 25 mm. (Pl. XXIII, fig. 2). The largest specimen of a very long series is 60.5 mm. long.

M. Cossmann has figured a quite small specimen from Santo Domingo, under the name *Oliva giraudi*, but which appears to us indistinguishable from *O. cylindrica* except by its smaller size. The length he gives for the species, 93 mm. is probably an error for 33 mm.

Oliva proavia Pils. and Johns. Plate XXIII, fig. 1.

Proc. A. N. S. Phila., 1917, p. 164.

This fine Olive requires comparison with *O. cristobalcoloni* Maury, which may prove to be an immature specimen of the same species. It is relatively broader, with a differently shaped spire and more fully developed plaits on the inner lip.

Oliva brevispira Gabb. Plate XXIII, fig. 4.

Oliva brevispira Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 215.

This species resembles *O. reticularis* in form, but is distinguished from other Tertiary and recent species of the region by its very short spire. The greatest width is above the middle. About 30 small plaits are on the inner lip. These are somewhat unequal and unevenly spaced, some being spaced by pairs. The siphonal fasciole is strongly oblique, its upper ledge entering above the middle of the inner lip.

Length 34.5, diam. 14 mm., length of aperture, measured to the suture, 30 mm.

The type, no. 2997 A. N. S. P., is somewhat worn, and none of the six examples is quite perfect. By the shape of the columella it has some resemblance to *O. nebulosa* Lam. *O. brevispira* of Maury is a different species.

Oliva gradata Gabb. Plate XXIII, figs. 10, 11.

Oliva gradata Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 215.

The special character of this species is that there is a sharp though

slight off-set or ledge encircling the last whorl a short distance (nearly 3 mm.) below the suture. On the whorls of the spire this is concealed by a smooth callus deposit over the inter-sutural space. The spire is straightly conic up to the nipple-like 2 or 3 apical whorls. The inner lip has about 15 strong, evenly spaced plaits.

Length 28.5, diam. 12 mm.; aperture, measured to suture, 20 mm.

The type, with two slightly smaller specimens, is no. 2998 A. N. S. P.

Olivella dimidiata Pils. and Johns. Plate XXIII, fig. 8.

Proc. A. N. S. Phila., 1917, p. 165.

Olivella muticoides (Gabb) Plate XXIII, figs. 5, 6, 7.

Olivella muticoides Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 215.

Olivella canaliculata Gabb, *tom. cit.* p. 215. Not of H. C. Lea.

Gabb's two descriptions apply to the high- and low-spired extremes of a single species. The large series before us contains completely transitional examples.

A thick labial callus extends from the basal fasciole to the suture, its abrupt edge straight and parallel with the lip.

Length 19.8, diam. 8 mm., length of aperture 13 mm. (type of *muticoides*).

Length 18, diam. 8.5 mm., length of aperture 13.3 mm. (type of *canaliculata*).

Of the three specimens figured, fig. 7 represents the type of *muticoides*, fig. 6 a transitional example, and fig. 5 the type of *canaliculata*.

The type and two other specimens of *O. muticoides* are no. 2805 A. N. S. P.; the type of *O. canaliculata* is no. 2806 A. N. S. P.; numerous other specimens.

Olivella floralia (Duclos)

Olivella oryza Lam., Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 215.

Olivella indivisa Guppy, Proc. U. S. Nat. Mus. xlx, 1896, p. 308, pl. 30, fig. 10.

We can find no character to distinguish this from the recent species of the same region.

Olivella mutica (Say)

Olivella mutica Say, Journ. Acad. Nat. Sci. Phila., ii, 1822, p. 22.

Voluta nitidula Dillwyn, in part, and of authors; not of Deshayes, 1837.

Several specimens agree in every way with the recent form. *Voluta nitidula* Dillwyn was a composite species, including *mutica* Say and *O. pusilla* Marratt. If the name is used at all, we suggest that it be taken for *O. pusilla*.

Olivella nivea (Gmelin).

One specimen is referable to this recent species.

Olivella rosalina (Duclos).

Two specimens having entirely the form of this recent species.

HARPIDAE.

Harpa americana n. sp. Plate XXIII, fig. 13.

H. rosea Lam., Gabb, Tr. Am. Philos. Soc. xv, p. 214.

The shell is ovate, of about 6 whorls, of which three smooth ones form the nipple-shaped embryonic shell, the last whorl of which, together with part of the first sculptured whorl, are very narrow. The last whorl has about eleven low and narrow axial ribs which rise into small spines where they pass over the angle bounding a narrow flattening below the suture. The whole surface below this angle is spirally striate, the striation strongest in the concavity of the sides below. The aperture is narrow for this genus. A thin callus spreads forward over the ventral convexity.

Length 33.3, diam. 28.6 mm.

This form is very similar to the recent *Harpa rosea* Lam. (*H. doris* Bolt.), but specimens of that species of the same size have more ribs and a wider aperture.

Type no. 4061 A. N. S. P.

MARGINELLIDAE.

Marginella sowerbyi Gabb. Plate XXIII, fig. 14.

Marginella sowerbyi Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221.

A markedly biconic species. The second and third columellar plaits have flattened and slightly furrowed summits, the fourth being flattened.

Length 14.5, diam. 8.1, length of aperture 10.5 mm.

A much smaller example, length 8.2 mm., with the type, shows traces of coloration. There are 5 spiral zones, the upper, middle and lower vertically lineolate with white, the other two having spotted borders and uniform median bands.

Type no. 2498 A. N. S. P.

Marginella nugax Pils. and Johns. Plate XXIV, fig. 14.

Proc. A. N. S. Phila., 1917, p. 165.

Marginella coniformis Sowerby.

Marginella coniformis Sowb., Q. J. Geol. Soc. vi, 1849, p. 45. Guppy, *l. c.* xxii, 1866, p. 288, pl. 17, fig. 2. Dall, Proc. U. S. Nat. Mus. xix, 1896, p. 309.

Several specimens. Guppy's figure is very poor, even for a Jamaica specimen. As a rule these are somewhat narrower than shells from Santo Domingo. It seems very close to, if not identical with, *M. aurora* Dall, from the Oligocene bed of the Chipola River; but we have not been able to compare specimens of the latter.

Marginella domingoensis Dall.

Marginella domingoensis Dall, Proc. U. S. Nat. Mus. xix, 310, 1896.

Four specimens we refer to this species. Dr. Dall writes: "This species is close to *M. aurora* Dall, from the Chipola marl, but has the tip of the spire less conspicuous and the aperture quite flexuous instead of nearly straight." Length 24 mm., greatest diam. 14 mm.

Marginella cercadensis Maury.

Marginella chrysomelina Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221.

Four specimens, no. 3269. On two, traces of the spiral color lines may be seen.

Marginella latissima Dall.

Marginella latissima Dall, Proc. U. S. Nat. Mus. xix, 1896, p. 308, pl. 29, fig. 11.

The specimens of this species from Santo Domingo represent a great range of variation, but with many before us it seems impossible to assort them except by sizes. Gabb referred these doubtfully to *M. apicina* on the label, but he did not mention the species in his work.

Marginella amina Dall.

Marginella amina Dall, Proc. U. S. Nat. Mus. xix, 1896, p. 309, pl. 29, fig. 15.

Two specimens are labeled in Gabb's handwriting "*M. antiqua* Redfield", but they are not mentioned in his work.

VOLUTIDAE.

Lyria pulchella (Sowerby)

Voluta pulchella Sowerby, Q. J. Geol. Soc., vi, 1849, p. 46, pl. 9, fig. 4.

Lyria pulchella Sby., Gabb, Tr. Am. Philos. Soc., xv, p. 219.

Lyria pulchella Sby., Dall, Bull. U. S. Nat. Mus. No. 90, p. 58, pl. 10, fig. 11.

Sowerby has given a good figure of this species. In some specimens the axial ribs become obsolete on the last whorl.

Lyria mississippiensis (Conr.) of the Vicksburg Oligocene is a closely related form. Dr. Dall has recorded *L. pulchella* from the silex beds at Ballast Point, Florida.

Lyria soror (Sowerby) Plate XXIV, figs. 11, 12.

Voluta soror Sowerby, Q. J. Geol. Soc. vi, 1849, p. 46.

The axial ribs are somewhat flexuous and much more delicate

than in *L. pulchella*; the anterior spirals are stronger; finally the apical whorls differ. In *L. pulchella* there are $1\frac{1}{2}$ smooth whorls, the first one globose and bulging, the second narrower. In *L. soror* the summit is smaller, the whorls increasing regularly, and there are $1\frac{3}{4}$ smooth ones. These differences certainly indicate specific divergence.

Aurinia striata (Gabb) Plate XXIII, fig. 9.

Scapha striata Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 219.

Scaphella (Aurinia) striata Gabb, Dall, Trans. Wagn. Inst. iii, 1890, p. 88.

The rounded summit ($\frac{3}{4}$ of a whorl) is worn; after that all of the whorls are closely striate spirally. The first $2\frac{3}{4}$ whorls have a sub-cylindric shape; then small nodules appear above the middle, which becomes subangular. The last whorl has a prominent rounded ridge at the shoulder, closely set with about 22 compressed nodes. Two columellar plaits remain on the type, which is broken anteriorly. In a very young one there are three.

Length as broken 25, diam. 11.5 mm. Nearly 5 whorls.

Gabb's type, no. 3274 A. N. S. P., is a young shell; another 13 mm. long was taken. The consideration of the species by Dall referred to above, should be consulted.

MITRIDAE.

Mitra henekeni Sowerby.

Mitra henekeni Sowerby, Q. J. Geol. Soc., vi, p. 46, 1849, pl. 9, fig. 5.

Adult specimens have but two columellar plaits, with sometimes the very weak trace of a third; in young specimens the third plait is more distinct. Sowerby's illustration is good, though the specimen was incomplete.

M. henekeni resembles the following species, but it is less slender, the whorls are more convex, and are acutely carinate below the channelled suture.

Length 58, diam. 15 mm. Broken specimens indicate that it reaches a length of about 65 mm.

Mitra longa Gabb. Plate XXIV, fig. 3.

Mitra longa Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 219. Brown and Pilsbry, Proc. A. N. S. Phila. 1911, p. 346, pl. 24, fig. 11.

A very slender shell with three well-developed columellar plaits and traces of two more. The acute spiral cords alternate with smaller ones, the intervals having some spiral threads, more numerous near the base. The intervals are crossed by even, fine axial threads.

Length 61.3, diam. 13.6 mm. The largest one is somewhat broken, but evidently had a length of about 75 mm.

Type and 12 other specimens are no. 3263 A. N. S. P.

Mitra titan Gabb. Plate XXIV, figs 1, 2.

Mitra titan Gabb, Trans. Amer. Phil. Soc. xv, 1873, p. 220.

Mitra symmetrica Gabb, *l. c.*

This large species reminds one of *M. millingtoni* Conr., from the Jacksonian Eocene, but has finer revolving and more prominent longitudinal lines, it is also somewhat wider in proportion to its length.

The adult stage is represented by one specimen, broken at both ends (Pl. XXIV, fig. 2), in its mutilated condition measuring, length 106.3, diam 43 mm. The spire shows fine spirals, every fourth one deeper; tapering base densely striate spirally, the peripheral region of the last whorl being smooth. In the young stage, represented by Gabb's *Mitra symmetrica* (Pl. XXIV, fig. 1), the whole surface is closely sculptured with spiral cords, on the upper part of the last whorl alternating with smaller threads; the intervals being beautifully sculptured with very fine axial threads as in *M. longa*. Length of *M. symmetrica* 51.2, diam. 13.8 mm. The types of both *M. titan* and *M. symmetrica* show four columellar plaits, the lower one small and hardly visible in a front view.

Five specimens around 50 to 80 mm. long, afford the stages connecting *symmetrica* and *titan*.

Type of *M. titan* no. 3261 A. N. S. P. 5 smaller specimens are contained in no. 3267.

Type of *M. symmetrica* no. 3260 A. N. S. P.

Mitra rudis Gabb. Plate XXIV, figs. 4, 5.

Mitra rudis Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 220.

Mitra quemadica Maury, Bull. Amer. Pal. v, p. 75.

The last whorl has about nineteen low, rounded, spiral cords, five of which are visible on the whorls of the spire. These are crossed and made subgranular by very irregular, subobsolete, axial wrinkles or growth lines. In the adolescent shell there are raised threads across the intervals, which appear pitted. Between the upper spiral cord and the next, there is a wider interval.

Length (summit broken) 31.3, diam. 13.8 mm.

Type is no. 3262 A. N. S. P., with 5 smaller examples.

Mitra granulosa Lamarck.

We refer a young specimen 18 mm. long to this recent species.

Mitra barbadensis (Gmelin)

The single specimen is rather worn, but agrees well with recent specimens.

Mitra mesolia Pils. and Johns. Plate XXIV, fig. 10.

Proc. A. N. S. Phila., 1917, p. 166.

Vexillum tortuosellum (Pils. and Johns.) Plate XXIV, fig. 9.

Mitra tortuosella Pils. and Johns., Proc. A. N. S. Phila. 1917, p. 165.

Vexillum tortuosellum frater (Pils. and Johns.) Plate XXIV, fig. 13.

Mitra tortuosella frater Pils. and Johns., Proc. A. N. S. Phila. 1917, p. 166.

Vexillum tortuosum (Gabb) Plate XXIV, fig. 8.

Mitra tortuosa Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 220.

There are about fifteen sharp, axial ribs on the last, eleven or twelve on the penult whorl. Between them are many impressed spiral lines, eleven or twelve on the penult whorl, parted by convex intervals which become spiral cords towards the anterior end of the shell, the axial ribs disappearing there. There are four columellar plaits, and the outer lip is closely lirate within.

Length 32.3, diam. 11.5 mm.

Type and 4 other specimens are no. 3284 A. N. S. P.

Plochelæa crassilabrum Gabb. Plate XXIV, fig. 6.

Plochelæa crassilabra Gabb, Proc. A. N. S. Phila. 1872, p. 272, pl. 11, fig. 5
(Feb. 11, 1873.)

Plochelæa crassilabrum Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 216.

The shell is smooth, oblong, widest above the middle, solid; spire straightly conic; suture scarcely impressed, ascending in front. Last whorl swollen above, the anterior two-thirds slowly tapering: terminating in a massive but low and rounded varix. The aperture is sinuous, the upper half narrow, lower half dilated; lip thick, blunt, the outer margin inflected, widest in the middle, dilated near the base. Anterior canal deep. Columella crossed by an emerging callus which is thickened in the lower half; bearing five low, rounded, parallel and contiguous entering plaits, the third one slightly the strongest.

Length 44.2, diam. 19.8 mm. Length of aperture measured from base to the end of the suture, 35.4 mm.

The type, represented by Gabb's figure and ours, is no. 3289 A. N. S. P. The eroded seat of an *Hipponix* scars the spire. In his later specific description, Gabb confused this species with the following one; his measurement and the phrase relating to the columellar plaits relating to the latter.

The spire is somewhat worn above, so that the number of whorls is uncertain.

The genus *Plochelæa* Gabb belongs, no doubt, to the Mitridæ. It stands close to, if not to be united with, the genus *Mutyca* H. & A. Adams, 1853, type *M. ancillides* Swains., with which *Mitroidea* Pease 1865, (type *M. multiplicata* Pse.), and *Mauritia* H. Adams, 1869, type *M. barclayi* H. Ad., are to be united as synonyms or sections. *Dibaphus* Philippi (1847), is another allied genus. With a knowledge of the above mentioned genera it seems strange that Gabb referred *Plochelæa* to the Olividae.

The type of *Plochelæa* is *P. crassilabrum* Gabb.

Plochelæa gabbi Pils. and Johns. Plate XXIV, fig. 7.

Proc. A. N. S. Phila., 1917, p. 166.

XANCIDAE.

Turbinellidae of authors.

The replacement of the name *Turbinella* by *Xancus* is one of the outrages against scientific nomenclature consequent upon the adoption of Bolten's *Museum* as a source of generic and specific names. The disappearance of the name *Turbinella* necessitates alteration of the family name.

This family is remarkably well developed in the Santo Domingo beds.

Xancus rex Pils. and Johns. Plate XXVI, figs. 5, 8.

Proc. A. N. S. Phila., 1917, p. 167.

The spire is longer than usual in *X. scolymus*, not shorter as stated in the original description. The inner lip often has the callus detached at the edge. The size of adults varies a good deal.

It is an abundant species, mistaken for *X. validus* by Gabb, Maury and others.

Xancus validus (Sowerby) Plate XXV, fig. 3.

Turbinellus validus Sowb., Q. J. Geol. Soc. vi, 1849, p. 50. Not of Gabb or Maury.

This species has been misunderstood by Gabb and Maury, owing to Sowerby's qualified comparison with *Turbinella scolymus*. The original description, however, is good, and the comparison not strained when one remembers that in 1849 *Turbinella* comprised also *Vasum*, *Latirus* and other genera.

The shell is obesely fusiform, ponderous. The embryonic stage is unknown, but the early and middle neanic whorls have thick,

rounded axial folds, weak below the suture, 6 or 7 on a whorl, and fine axial costulation, over which about 8 rather acute, narrow spiral threads run. On the last 2 or 3 whorls the axial folds are replaced by small, rounded tubercles disposed along a slight shoulder angle; the spirals become weak and sparse except towards the base. The suture is rather narrowly, deeply channelled. At resting stages and the final lip the suture rises very little. There are three strong plaits, the anterior one lowest and thickest. The largest shell measures 176 mm. long, 80 wide. This species differs from *X. rex* "in its tubercles, which are small and rounded," and the less emphatic sculpture generally.

X. validus differs from *Turbinella ovoidea* Kiener by the channelled suture and the more prominent axial folds of the spire. *T. regina* Heilpr. is more elongate than *X. validus* at all stages of growth. *T. scolymoides* Dall has more elaborate sculpture, the axial folds persisting longer, and the columellar plaits are smaller. *T. wilsoni* Conr. is more shouldered, with larger nodes. *T. polygonata* Heilpr. seems to resemble *T. wilsoni* rather closely, but no good adult specimens have been found.

Fasciolaria textilis Guppy¹⁹ is less excavated below the periphery than the present species, but a form of the Bowden bed which we had provisionally called *Xancustextilisjamaicensis* (Pl. XXV, figs. 5, 6) is rather closely related. It has conspicuous axial wrinkles above the shoulder, which is more developed and has larger nodes than *X. validus*. The first whorl following the embryonic stage has about twice as many axial folds as the succeeding whorls, and the suture is not in the least channelled.

A variety of *X. validus* with somewhat larger nodes at the shoulder was taken by Mr. L. B. Smith west of Azua, Haiti..

***Xancus præovoideus* Maury.**

Turbinella ovoidea Gabb, Trans. Amer. Philos. Soc. xv, p. 218; not *T. ovoidea* Kiener, 1840.

Xancus præovoideus Maury, Bull. Amer. Pal. v, p. 83.

Xancus præovoideus Maury, op. cit. p. 241.

This fine shell, which Gabb collected in considerable quantity, differs from the recent *X. ovoideus* by the strong sculpture of the neanic whorls, as Miss Maury has pointed out. It reaches a length of 175 to about 200 mm. The suture usually rises abruptly at resting stages and behind the final peristome.

It differs from *X. validus* by the smoother later whorls. In a

¹⁹ Geol. Mag. 1874, p. 140, pl. 16, fig. 5.

few specimens weak traces of the shoulder tubercles can be seen, suggesting a transition to *X. validus*, which has exactly the same early sculpture; but no evidence of an actual intergradation is at hand.

Vasum dominicense Gabb Plate XXVII, figs. 4, 5.

Vasum dominicensis Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 218.

Closely related to the recent *V. capitellum* (L.), but the shoulder is less developed. There are eight obtuse, massive folds on the last whorl, the intervals clathrate. The outer lip is rather weakly lirate within and the columella has three rather small plaits.

Length 60, diam. 37.5 mm. Type, fig. 5.

Length 32, diam. 19 mm. Fig. 4.

Type and a smaller shell are no. 2623 A. N. S. P.

Vasum haitense (Sowerby)

Turbinella haitensis Sowerby, Q. J. Geol. Soc., vi, p. 50. Guppy, Q. J. Geol. Soc. xxxii, 1876, p. 523, pl. 29, fig. 3.

Vasum haitense Sowb., Gabb, Tr. Am. Philos. Soc. xv, p. 218.

Twelve specimens. It becomes very large and ponderous.

Vasum tuberculatum Gabb. Plate XXVII, figs. 2, 3.

Vasum tuberculatum Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 218.

This species is very distinct from *V. haitense*, and in fact from all others known to us. The spire is much higher than in *haitense*. Seven very large tubercles on the shoulder of the last whorl are bifid at their summits, a swelling being superposed below the crest. The inferior tubercular ridge is somewhat smaller than in *haitense*, and there are slightly tubercular, very much smaller ridges above and below it. Five weak columellar plaits.

Length 112, greatest diam. 87 mm.

Type is no. 2624 A. N. S. P.

Vasum edificatum (Guppy)

Turbinellus edificatus Guppy, Q. J. Geol. Soc., xxxii, 1876, p. 523, pl. 28, fig. 5.

Vasum subcapitellum Heilprin, Trans. Wagner Free Inst. Sci., i, 188, p. 109, pl. 15, fig. 44. Dall, same Trans., iii, 1890, p. 99, pl. 4, fig. 12.

?*Vasum dominicense* Gabb, var. *gurabicum* Maury, Bull. Amer. Pal. v, p. 84.

Vasum subcapitellum, from the Oligocene of Ballast Point, differs only in being somewhat smaller than Santo Domingo specimens.

The neanic stage is rather profusely spinose. Guppy's figure shows the much less spinose adult stage.

Vasum pugnus Pils. and Johns. Plate XXVII, fig. 1.

Proc. A. N. S. Phila., 1917, p. 167.

FASCIOLARIIDAE.

Leucozonia rhomboidea (Gabb) Plate XXVI, fig. 9.

Lagena rhomboidea Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 218.

The first whorl is globose with a depressed tip; $1\frac{1}{2}$ smooth whorls form the embryonic shell. The following whorl has axial folds and spiral threads, the folds weakening and finally disappearing on the succeeding whorls, but persisting as low, rounded peripheral nodes on part of the last whorl. The narrow furrow encircling the base has raised edges in the latter part. Outer lip is lirate within. There are three small columellar plaits.

Length 13.6, diam. 8 mm.; $6\frac{1}{3}$ whorls.

It is probably ancestral to the recent *L. cingulifera*.

Type and a smaller specimen are no. 2947 A. N. S. P.

Latirus infundibulum (Gmel.)

Gabb, Tr. Amer. Philos. Soc. xv, p. 27.

Four specimens. The secondary spirals are a little more developed than in recent shells.

Latirus brevicaudatus santodomingensis n. subsp. Plate XXV, fig. 4.

Differs from recent *L. brevicaudatus* by the smaller, more numerous primary spiral cords. On the convexity of the later whorls secondary spiral threads occupy the intervals, and on the last part of the last whorl there are some threads of the third order.

Length 57, diam. 24.5 mm.

Type is no. 2952 A. N. S. P.

Latirus fusiformis Gabb. Plate XXVI, figs. 2, 3.

Latirus fusiformis Gabb, Tr. Amer. Philos. Soc., xv, p. 217.

Smaller and more slender than *L. infundibulum*, with narrower and more numerous axial folds, rather abruptly terminated above, nine on the last whorl. The spiral cords are also smaller. There are some rather widely spaced, unequally grouped and irregular axial lamellae below the suture.

Length 31.5, diam. 12 mm.

Type no. 2954 A. N. S. P.

Latirus elongatus Gabb. Plate XXVI, fig. 4.

Tr. Amer. Philos. Soc. xv, 1873, p. 217.

This species is distinguished by its unusually long anterior canal. The penult whorl has ten, last whorl nine axial folds. Spiral cords are small above, larger and more spaced on the canal. Only the last two whorls of the type are preserved. As broken the specimen measures:

Length 49.5, diam. 17.5 mm.

Type no. 2955 A. N. S. P.

Latirus angustatus Gabb. Plate XXVI, fig. 1.

Latirus angustatus Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 217.

The single specimen, in poor preservation, differs from *L. elongatus* by the greater number of axial folds, 11 on the last whorl. There are some very weak lirae within the outer lip, the lower ones broken into granules, as in *L. elongatus*. We suspect that *angustatus* is merely a young *elongatus*.

Length 27 mm (spire and canal broken), diam. 11 mm.

Type no. 2950 A. N. S. P.

Latirofuscus exilis (Gabb) Plate XXV, fig. 1.

Latirus exilis Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 217.

The last whorl has five broad, rounded axial folds, which extend upon the narrow anterior part. Whorls of the spire with four spiral cords, the lower partly concealed in the suture. There are four acute lirae within the outer lip, and two small, subhorizontal plaits on the columella.

Length 31.4, diam. 9.3 mm.

This is a typical species of *Latirofuscus* Cossmann. The genus is represented in the American Oligocene (Vicksburg) by *L. perexilis* (*Cordieria perexilis* Conrad), and in the Eocene (Lower Claiborne) by *L. harrisi* Johns., (which proves to be a synonym of *L. perexilis*), and *L. obtusa* Johns.; in the Jackson bed by *L. leaënsis* Harris.

Type no. 2948 A. N. S. P.

Fasciolaria kempii Maury.

Fasciolaria intermedia Sby., Gabb, Tr. Am. Philos. Soc. xv, p. 217.

In some specimens the last whorl has a rounded shoulder, without tubercles. In others the tubercles extend to the lip. Up to 12 cm. long.

Fasciolaria semistriata Sowerby.

Fasciolaria semistriata Sowerby, Q. J. Geol. Soc. vi, 1849, p. 49.

Fasciolaria semistriata Sowb., Guppy Q. J. Geol. Soc. xxii, 1866, p. 288, pl. 16, fig. 12.

Fasciolaria semistriata Sowb., Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 216.

Fasciolaria intermedia Sowerby, Q. J. Geol. Soc. vi, 1849, p. 49.

The great convexity of the whorls and the concavity below the suture are characteristic. It seems to have had dark spiral lines, like *F. distans*, with sculpture more like *F. tulipa*. Anterior canal is very long and slender. The early neanic whorls have low axial folds and spiral striae. Length 104 mm.

Fusinus haitensis (Sowerby)

Fusus haitensis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 47.

Fusus henekeni var. *haitensis* Guppy, Q. J. Geol. Soc., xxii, pp. 524, 532, pl. 28, fig. 2.

One broken specimen and two young ones with subangular whorls are referred to this species. Without more material we cannot say whether it is distinct from *F. henekeni* or a variety thereof.

Fusinus henekeni (Sowerby) Plate XXVI, figs. 6, 7.

Fusus henikeri Sowerby, Q. J. Geol. Soc. vi, 1849, p. 49.

Fusus henekeni Sowb., Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 204.

Fusus henekeni Guppy, Q. J. Geol. Soc. xxxii, 1876, p. 524, pl. 28, fig. 6.

The figure given by Guppy is poor; the whorls should be more convex, and the spiral ridges larger and less numerous, there being only six or seven visible on the whorls of the spire. Many of the specimens show alternating spiral ridges on the larger whorls. Sowerby does not mention this character, but as Guppy's figure shows it indistinctly, we would consider the form with alternating sculpture to be typical.

It probably represents the ancestral form of *F. eucosmius* Dall, now living in 27-73 fathoms in the Gulf of Mexico and West Indies.

Length of the form with subequal spirals 71, diam. 22 mm. A specimen with prominent alternating spirals on the two large whorls (obsolete on the next earlier) measures length 89, diam. 26 mm.

It appears to be an abundant species.

Melongena (?) **antillarum** (Gabb) Plate XXVIII, figs. 10, 17.

Hemifusus antillarum Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 204.

The largest cotype (fig. 17) has lost all of the spire, the last whorl measuring, length 79, diam. 49.5 mm., aperture 63 mm. There is a small ridge in the position of the inferior spine-series of the recent Gulf species of *Melongena*. The strongly lirate interior is a prominent feature. The smaller cotype (fig. 10) is a young shell 43.6 mm. long.

A fragment of the canal indicates a size somewhat exceeding the larger specimen. Two cotypes, with an additional fragment, no. 2797 A. N. S. P.

Melongena consors (Sowerby)

Pyrula consors Sowb., Q. J. Geol. Soc. vi, 1849, p. 49.

Melongena melongena L., Gabb, Tr. Am. Philos. Soc. xv, p. 205.

Very closely related to *M. melongena*, but differing by having strong spiral striation in the adult stage. It is also more ponderous. The height of the spire varies a good deal. The variations in the

spines are the same as in *M. melongena*. The largest in the series is about 15 cm. long.

The early neanic stage is unarmed as in *M. melongena*, and sometimes it is lirate within the aperture.

A single specimen with all the appearance of an adult is only 36 mm. long (no. 2798 A. N. S. P.). It is probably a dwarf, comparable to the well known dwarf form of *M. corona*, inhabiting inlets probably deficient in salinity. (Pl. XXXI, fig. 5)

Melongena orthacantha Pils. and Johns. Plate XXVIII, figs. 13-16.

Proc. A. N. S. Phila., 1917, p. 168.

Nassaria corrugata (Gabb) Plate XXII, fig. 15 (*N. brevis*).

Muricidea corrugata Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 203.

Nassaria brevis Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 213.

The characters of the types of these species are the same except that *brevis* is larger. The latter has a rather bulbous embryonic shell of $1\frac{1}{2}$ smooth whorls. The following $\frac{1}{3}$ whorl has numerous narrow axial ribs, after which there are strong, evenly spaced axial folds, 9 on the last whorl. These are traversed by acute spiral cords, of which there are six on the penult whorl, with minor threads in two or three of the intervals. The two cords above the suture are small, following two at periphery larger. The mouth is strongly lirate within, and the columella has four short, somewhat ascending plaits. There is also an entering cord near the posterior angle of the mouth.

Length 20, diam. 13 mm.; $7\frac{1}{2}$ whorls.

The type of *M. corrugata* has 8 folds on the last whorl. It measures: length 15, diam. 9.4 mm. $6\frac{2}{3}$ whorls. As it has been broken and repaired, and there is no question of the absolute identity with *N. brevis*, the latter only has been figured.

Type of *M. corrugata* is no. 3247 A. N. S. P.; of *N. brevis*, no. 3246 A. N. S. P.

BUCCINIDAE.

Phos semicostatus Gabb. Plate XXII, figs. 23. 24. 25..

Phos semicostatus Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 212.

A variable species. Typically the coarse folds of the spire give place to fine axial folds on the last whorl, with one to three variceal folds, but sometimes the stronger folds are somewhat numerous, a few examples having seven or eight on the last whorl.

Length 34, diam. 16.6 mm. Type no 3241 A. N. S. P.

Length 34, diam. 18 mm.

Length 33.3, diam. 15.6 mm.

Phos metuloides Dall, Proc. U. S. Nat. Mus., xix, p. 310, pl. 28, fig. 15, from Ponton, Santo Domingo, was not obtained by Gabb.

Phos gabbi Dall.

Phos veraguensis Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 212. (Not Hinds.).

Phos gabbi Dall, Proc. U. S. Nat. Mus. xix, 310, pl. 29, fig. 4. 1896.

Though undoubtedly distinct, this species is closely related to *P. moorei* Guppy, from the beds at Bowden, Jamaica.

Phos elegans Guppy.

Phos elegans Guppy, Quart. Journ. Geol. Soc. xxii, 1866, p. 290. pl. 16, fig. 11.

Numerous specimens referable to this species were found associated with the specimens labeled *veraguensis* by Gabb.

Phos guppyi Gabb. Plate XXII, figs. 16, 17, 18.

Phos guppyi Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 212.

The few longitudinal costae and numerous fine revolving raised lines distinguish this species. The sculpture of the neanic stage is sometimes continued in the adult, as in fig. 18.

Length 38, diam. 17.4 mm. (Type fig. 17).

Length 33.4, diam. 15 mm. (Fig. 16).

Type no. 3243 A. N. S. P.

Phos (Strongylocera) costatus Gabb. Plate XXII, figs. 10, 14.

Phos costatus Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 212.

Phos fasciolatus Dall, Proc. U. S. Nat. Mus. xix, 311, pl. 28, fig. 12, 1896.

The number of longitudinal folds on the last whorl varies from 8-12. Dall's *P. fasciolatus* from the Oligocene at Potrero, Rio Amina, Santo Domingo, is a form or variety of *costatus* characterized by having 14 somewhat narrower ribs, but entirely similar in other respects.

Length 31 mm., greatest diam. 17 mm.

Type no. 3242 A. N. S. P.

Metula cancellata Gabb. Plate XXII, figs. 19, 20.

Metula cancellata Gabb, Tr. Am. Philos. Soc. xv., 1873, p. 205.

There are two specimens of this exquisite species, the larger one (type) measuring, length 24.5, diam. 8 mm., aperture 13.3 mm. It has lost the embryonic whorls.

Type no. 3244 A. N. S. P.

COLUMBELLIDAE.

Columbella inflata (Gabb) Plate XVIII, fig. 14.

Strombina inflata Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221.

This species is distinguished by its inflated form, the last four whorls being subangular near the suture. There is a very broad, low varix occupying the last fifth of the last whorl, giving it a gibbous appearance, then contracting to the lip.

Length 25.6, diam. 13.4 mm.

The type is no. 3287 A. N. S. P. One specimen only.

Anachis exilis (Gabb) Plate XVIII, fig. 13.

Strombina exilis Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 222.

Anachis exilis Gabb, Dall, Tr. Wagner Free Inst. Sci., iii, p. 139.

The whorls have about 15 straight axial ribs, the last one with spiral cords on the anterior third. Over a small area behind the lip-varix the axial ribs are effaced except near the suture.

Length 4.3, diam. 2 mm.

Type no. 2807 A. N. S. P. Twelve other specimens.

Anachis gracilicostata Pils. and Johns. Plate XVIII, fig. 17.

Proc. A. N. S. Phila., 1917, p. 168.

Anachis (?) quadrata (Gabb) Plate XVIII, fig. 8. Text-fig. 16.

Fusus quadratus Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 204.



Fig. 16
Basal outline
of *A. quadrata*.

The smooth embryonic shell has $2\frac{1}{2}$ whorls. First post-nuclear whorl has 10 rounded ribs, after which the ribs rapidly become more widely spaced, until on the last whorl there are five, and in a basal view (text fig. 16) the shell has a square outline. There is no bend in the delicate growth-lines to indicate a posterior sinus, though the aperture otherwise has a *Drillia*-like appearance. In the concavity below the periphery there are fine spiral striae. The columella is broad with rounded face.

Length 8.7, diam. 4 mm.; 8 whorls.

Type no. 3234 A. N. S. P.

The generic place of this strongly marked little shell is uncertain.

Strombina caribaea Gabb. Plate XVIII, fig. 9.

Strombina caribaea Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221.

This species has a slender, acuminate spire. The surface is smooth except on the narrow anterior part, which has about 12 spiral cords. The lip has a very heavy varix, and six large and sev-

eral small teeth within, below the middle. There is a very heavy callus on the parietal wall, and about 6 teeth on the columella.

Length 10.2, diam. 5.2 mm.; length of aperture 5.8 mm. $8\frac{1}{2}$ whorls.

Type and two other adult and three young specimens are no. 3996 A. N. S. P.

It is well distinguished from *S. haitensis* by the slender, smooth spire.

S. caribaea micra n. var. Plate XVIII, figs. 10, 11.

Smaller and narrower than the preceding, with 8 basal cords, three teeth within the outer lip and none on the columella.

Length 5.8, diam. 2.7 mm.; $7\frac{1}{2}$ whorls.

The two figures represent the same specimen, fig. 11 being the same scale as fig. 9.

Type no. 2800 A. N. S. P.

Strombina haitensis (Sowerby)

Columbella haitensis Sowerby, Q. J. Geol. Soc. vi, 1849, p. 46.

Strombina haitensis Sby., Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221.

Distinguished by the straight axial ribs of the spire, and small ridge revolving immediately below the suture. Length 8.5 mm.

Strombina politissima Pils. and Johns. Plate XVIII, fig. 15.

Proc. A. N. S. Phila., 1917, p. 168.

S. mira Dall, from Gatun, has a small prominence below the suture, wanting in *politissima*, and the last whorl is striate from the periphery down. Otherwise our species appears very close to it.

Strombina prisma Pilsbry and Johnson.

Strombina prisma P. and J., Proc. A. N. S. Phila. 1911, p. 352, footnote, pl. 25, figs. 9, 10.

Strombina gradata Guppy, in part, Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221. Not of Guppy.

The type and six other specimens are no. 3292 A. N. S. P.

Strombina cyphonotus Pilsbry and Johnson.

Strombina cyphonotus P. and J., Proc. A. N. S. Phila. 1911, p. 353, footnote, pl. 25, figs. 6, 7.

Strombina gradata Guppy, in part, Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 221. Not of Guppy.

The type and eight other specimens are no. 3893 A. N. S. P.

Strombinella acufornis Dall.

Strombinella acufornis Dall, Proc. U. S. Nat. Mus. xix, p. 312, pl. 29, fig. 6.

Potrero, Rio Amina, Dall; Santo Domingo, Gabb, no. 2960, four specimens.

Metulella venusta (Sowerby)

Columbella venusta Sowb., Q. J. Geol. Soc. vi, 1849, p. 46, pl. 9, fig. 6.

Metulella venusta Sowb., Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 206.

This species reaches a length of 30 mm. It is the type of the genus *Metulella*.

Nassaria isthmica Böse var. *elongata* Toulou. Jahrb., k. k. Geol. Reichsanst 1911, pl. 29, fig. 8, appears to be a related *Metulella*.

Metulella fusiformis Gabb. Plate XVII, fig. 16.

Metulella fusiformis Gabb, Proc. A. N. S. Phila. 1872, p. 270, pl. 11, fig. 3 (Feb. 11, 1873); Tr. Am. Philos. Soc. xv, 1873, p. 206.

The embryonic shell is like that of the following species. Subsequent whorls have many narrow, rounded vertical ribs crossed by somewhat flattened but prominent spiral cords, of which there are five between sutures. There is a low swelling behind the outer lip. Suture is somewhat channeled.

Length 18.6, diam. 6 mm.; $9\frac{1}{2}$ whorls.

Type no. 3216 A. N. S. P.; 5 other specimens.

Metulella dominicensis Pils. and Johns. Plate XVIII, fig. 18.

Proc. A. N. S. Phila., 1917, p. 169.

Perhaps not distinct from *M. williamgabbii* Maury, but that is described as having "spiral striae faint, obsolescent" which is not the case with our two specimens, in which the spirals are strongly developed.

MURICIDAE.

Murex (Chicoreus) brevifrons Lamarck.

Murex brevifrons Lam., An. sans Vert. vii, 1822, p. 161.

Murex (Chicoreus) megacerus Sby. Gabb, Tr. Am. Philos. Soc. xv, 1876, p. 202. (Not of Sowerby).

Murex cornupectus Guppy, Q. J. Geol. Soc. xxxii, 1876, p. 521, pl. 28, fig. 4.

There appears to be no character distinguishing the Miocene specimens from the recent. Ten specimens, no. 3256.

Murex rufus compactus Gabb. Plate XXVIII, fig. 1.

Murex (Pteronotus) compactus Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 202.

This differs from the recent *M. rufus* in being much thicker, the frondose structure of the varices is more compact, forming almost solid varices squamose in front. Only one tubercle is present between the varices on the last two whorls, two on the preceding whorl. The greater number of recent specimens have two intervariceal tubercles.

Length 56.4, diam. 32.3 mm.

Type and four other specimens are no. 3258 A. N. S. P.

Murex (Pteropurpura) textilis Gabb. Plate XXVIII, fig. 4.

Murex (Pteronotus) textilis Gabb, Tr. Am. Philos. Soc., xv, p. 202. Dall, Trans. Wagner Free Inst., iii, p. 142, pl. 9, fig. 4.

Murex (Pteropurpura) textilis Dall, t.c. pt. 2, 1892, p. 243.

This beautiful species is also found in the Pliocene of the Caloosahatchie River, Florida. It has been well figured by Dr. Dall.

Length 31, diam. 17 mm.

Type no. 3257 A. N. S. P.

Murex recurvirostris Brod.

Murex recurvirostris Brod., Gabb, Tr. Am. Philos. Soc., xv, p. 201.

Murex messorius Sowb., Reeve, Conch. Icon., *Murex*, fig. 90.

This is an extremely variable species. In the large series before us from both the West Indies and the west coast of Central America and Mexico, we can find no invariable character by which to separate them aside from their geographic distribution. This does not seem ground for specific distinction, for the two have apparently existed unchanged since the Oligocene, when the Atlantic and the Pacific Oceans were still connected.

Murex domingensis Sowerby.

Murex domingensis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 49, pl. 10, fig. 5.

This differs from *M. recurvirostris* in usually having a noticeably higher spire, less spinose and slightly more elevated varices, with usually four intervariceal folds that are more evenly nodose (not tuberculate); the fine spiral lines alternating with the nodose spirals are more prominent, and the anterior canal is apparently shorter.

Murex yaquensis Maury.

Murex antillarum Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 202. Not of Hinds.

While resembling somewhat the extreme form of *M. domingensis*, this is no doubt specifically distinct. It is a more slender shell, with rounded, convex whorls, narrowly horizontal below the suture, varices smaller but more spinose; with six intervariceal costae that are crossed by alternating spiral cords, the larger of which where they pass over the costae form compressed nodes, about twelve to each rib. The smooth embryonic shell consists of two trochoidal whorls that are but slightly convex, and much less oblique than in *M. domingensis*.

Length 42, diam. 23 mm.

Length 36, diam. 18.4 mm. (Type of *M. antillarum* Gabb.)

There was an error in Gabb's measurements.

Trophon dominicensis Gabb. Plate XXVIII, figs. 2, 3.

Trophon dominicensis Gabb. Trans. Amer. Philos. Soc. XV, 1873 p. 202.

Murex dominicensis Dall, Proc. U. S. Nat. Mus. xix, 1896, p. 313.

Whorls seven, strongly angular, the axial ribs armed on the shoulder with a hollow spine; above the shoulder they are inflated and elevated above the suture. Above, and a short distance below the carina, the surface is smooth, except for a few very fine lines that are visible under the lens. Below there are conspicuous spiral cords.

Length 17.5, diam. 11 mm. (including spines).

Type no. 3252 A. N. S. P.

Probably *Murex* (*Trophon*) *werner*i Toulou, Jahrb. k. k. geol. Reichsanstalt lxi, 1911, p. 479, pl. 29, figs. 9a, b, should be added to the synonymy of *T. dominicensis*.

Muricidea striata Gabb. Plate XXVIII, fig. 7.

Muricidea striata Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 203.

Resembles *M. spinulosa* Heilprin (*M. heilprini* Cossmann) from the Oligocene of Ballast Point, in general appearance, but is much smaller and less elongate; the spire and anterior canal are shorter, the latter being more recurved; also less spinose.

Length 12.3, diam. 7.2 mm.

Type no. 3249 A. N. S. P.

Typhis alatus Sowerby.

Typhis alatus Sowb., Q. J. Geol. Soc., vi, 1849, p. 48, pl. 10, fig. 4.

Represented by only one immature specimen, no. 3250.

Typhis obesus Gabb. Plate XXVIII, figs. 5, 6.

Typhis obesus Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 203. Dall, Proc. U. S. N. M. xix, p. 313.

Typhis alatus var. *obesus* Dall, Trans. Wagner Free Inst. iii, p. 151.

The type, a single perfect specimen, no. 3251, measures: length 24.8, diam. 18 mm. Whether it is to be considered a variety of *T. alatus* depends upon the finding of specimens of intermediate form. The Bowden (Jamaica) series seems to fall into a longer and a shorter race, both smaller than those of Santo Domingo, but of similar shape.

Coralliophila abbreviata (Lam.)

Muricidea lata Gabb, Trans. Am. Philos. Soc., xv, 1873, p. 203.

Gabb's two specimens seem to be identical with this well known recent West Indian species. The type of *M. lata* is no. 3248 A. N. S. P.

Thais santodomingensis Pils. and Johns. Plate 28, figs. 8, 9.

Proc. A. N. S. Phila., 1917, p. 169.

Cymia henekeni Maury.

Cuma tectum Kiener, Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 214.

Cymia woodii (Gabb), in part, Dall, Trans. Wagner Free Inst. Sci., iii, p. 154.

Cymia woodii Gabb, Maury, Journ. Acad. Nat. Sci. Phila. (2), xv, p. 82.

Cymia henekeni Maury, Bull Amer. Pal. v, p. 104.

This is a variable species, as the figures given show, but careful comparisons of the series of over 100 specimens with the type of *Cymia woodii* (Gabb), from the Shiloh Miocene, convince us that the Santo Domingo species is distinct. The Miocene species has more even spiral sculpture, a rounded periphery, and none of the peripheral tubercles, which are present on some part of every specimen of *henekeni*.

In addition to the generic synonyms of *Cymia* given by Dall (Tr. Wagn. Free Inst. Sci. iii, 154), we may mention *Cumopsis* Rovereto, Atti Soc. Ligust. Sc. Nat. e Geogr., X, 1899, p. 105. *C. tectum* may be taken as type.

Cymia woodii is probably a derivative from *C. henekeni*, being the last member of the genus in Atlantic waters.

Cymia henekeni tectiformis n. subsp. Plate XXVIII, figs. 11, 12.

Cuma tectum Gabb, l. c. in part.

The shell is similar to *C. henekeni* as far as the middle of the penult whorl, where larger tubercles appear at the peripheral angle. On the last whorl there are about 8 such tubercles, those on the back being very prominent and widely spaced. Above the periphery there are many spirals, and below it the spiral striation is under-laid by about six low spiral ridges. Dense growth-striae as in *C. henekeni*.

Alt. 46, diam. 30 mm. Type; Pl. XXVIII, figs. 11, 12, no. 2794.

Alt. 45, diam. 32.5 mm.

A very large specimen, length 54.4 mm., has but six large tubercles on the last whorl. As the tubercles become progressively more widely spaced, the addition of a half whorl to the usual size decreases the number.

While the adult stage is conspicuously different, the half grown and young specimens are not distinguishable from *C. henekeni*. The two forms were mingled in Gabb's collection.

This form is superficially like *C. tectum*; but that recent Panamic species differs from all of the fossils by having comparatively few, flat spirals, parted by narrow, deeply engraved grooves. The columellar plait also, is heavier and more prominent.

CYMATIIDAE.

Cymatium pileare (Lamarck)

Tritonium (Lampusia) lineatum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 211.

The two shells are identical with recent specimens.

Cymatium domingense (Gabb) Plate XXIX, fig. 2.

Tritonium (Ranularia) domingense Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 212.

This species approaches *C. vespaceum* (Lam.) in many respects, but the more convex whorls, the prominent varices on the whorls of the spire, where there are also more numerous vertical ribs, are differential characters. Moreover, the embryonic shell is more depressed, the post-embryonic whorls enlarge more rapidly, forming a far thicker spire. The anterior canal is noticeably shorter.

Length 28.7, diam. 16 mm.

The type and a smaller specimen are no. 3226 A. N. S. P.

Cymatium præfemorale Maury.

Tritonium femorale Linn., Gabb, Trans. Amer. Philos. Soc., xv, p. 213.

Five specimens, the largest 10 cm. long.

Distorsio constrictus simillimus (Sowerby)

Triton simillimus Sowb., Q. J. Geol. Soc., vi, 1849, p. 48.

Distortia simillimus Sby., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 212.

Distortio simillimus Sby., Gabb, Journ. Acad. Nat. Sci. Phila., viii, p. 353.

The Santo Domingan form, which was named *Triton simillimus* by Sowerby, equals the recent *D. constrictus* in form and size (length 60 to 65 mm), but differs by having the spiral threads and striae between the spiral cords more conspicuous. The length of the anterior canal varies a good deal; when short it is often more reflexed. Except in the detail of sculpture mentioned, this form is identical with the recent *D. constrictus*.

Bowden specimens are smaller, with fewer minute spirals. The form reported by Gabb from the Pliocene of Costa Rica is entirely like the Santo Domingan examples.

D. gatunensis Toula, from the Gatun formation, has fewer and smaller spiral threads among the striae of the intervals, but is otherwise identical with the Santo Domingo race in adult sculpture; but it differs specifically by the larger embryonic shell, as stated by Brown and Pilsbry²⁰.

The genus *Distorsio* seems to have had its inception in the early

²⁰ Proc. A. N. S. Phila. 1911, p. 356.

Eocene of the Gulf or mid-American littoral. The *D. septemdentatus* of Gabb, a Lower Claibornian species of Texas, corresponds perfectly with what, on theoretical grounds, the earliest form of the genus should be.

It would seem that the groups *Ranularia*, *Lampusia*, and *Distorsio*, diverged about this time from a common stock. *D. septemdentatum* is but slightly distorted. The irregular bulging of the whorls, correlated with the rise and fall of the sutures and consequent alternate widening and contraction of the body chamber, has just begun, and is yet far less strongly developed than in any later species. The spreading callus, which masks the front in recent forms, has not appeared. The teeth are small, and the mouth not contracted in a grimace. The sculptural features of *Distorsio* are present, but the earlier whorls retain those of other small Eocene Tritons.

Acceleration along the lines foreshadowed in *D. septemdentatus* rapidly ensued, typical *Distorsios* appearing in the Vicksburg Oligocene. We may suppose that the group spread westward through the open strait between the Americas, and the swimming *Sinusigera*-like larvæ, caught in the Equatorial current, were carried to the West Indies. In southern Europe the genus appeared in the middle Miocene, but whether derived from America or the eastern seas is doubtful.

Of the recent species, *D. anus* (L.), the type of *Distorsio*, has strongly defined characters, everywhere recognized. The others have suffered great vicissitudes in nomenclature, and in order to determine the status of the Oligocene forms a revision of the specific nomenclature was undertaken. The following names and probably some others, have been proposed in the group:

- 1807 *Distortrix reticulata* Link, Besch. Rostock Samml, 122.
- 1809 *Murex cancellinus* Lam., Ann. du Mus. II, p. 225.
- 1811 *Distorta acuta* Perry, Conchology, pl. 10, fig. 1.
- 1817 *Murex mulus* Dillwyn, Catal. II, p. 704.
- 1821 *Murex tortuosus* Borson, Mem. Reale Accad. Sci. Torino, xxvi, p. 306, pl. 1, fig. 4.
- 1822 *Triton clathratus* Lam., Anim. s. Vert, ix, p. 186.
- 1829 *Triton personatum* M. de Serres, Geogn. Terr. Tert., p. 118, pl. 3, fig. 11, 12.
- 1833 *Triton constrictus* Broderip, P. Z. S., p. 5.
- 1844 *Triton ridens* Reeve, Conch. Icon., fig. 46.
- 1844 *Triton decipiens* Reeve, l. c. fig. 102.
- 1848 *Triton crassidens* Conrad, Jour. Acad. Nat. Sci. I. 118, pl. 11, fig. 40.
- 1849 *Triton simillimus* Sowerby, Quart. Jour. Geol. Soc., vi, 48.
- 1852 *Triton subclathratum* d'Orbigny, Prodr. Pal. Fr., III, 77, 175.
- 1860 *Distorsio pusilla* Pease, P. Z. S. p. 397.

- 1860 *Distorsio septemdentata* Gabb, Jour. Acad. Nat. Sci., iv, p. 380, pl. 67, fig. 21.
1873 *Triton grasi* (Bellardi), in d'Anconi, Malac. Plioc. Ital. II, p. 70, pl. 16, fig. 1.
1909 *Distorsio gatunensis* Tuola, Jahrb. K.-K. Geol. Reichsanst. lviii, 1908, p. 700, pl. 25, fig. 10.

Recent monographers have lumped all the living forms under one or other of the above names, but there seem to be three or four valid species among them. The principal synonymy of the recent forms is given below; that of the European Miocene species has been duly set forth by Bellardi.²¹

Distorsio reticulata Link. Includes *acuta* Perry, *cancellinus* Lam. (?), *mulus* Dillw., *pusilla* Pse., *cancellinus* Reeve.

This species is the common Indo-Pacific form. Its chief, and so far as we know, invariable character is the presence of a *prominent and somewhat gibbous bilirate ridge or keel at the shoulder, on the back of the shell*.

The strong entering fold on the upper part of the parietal wall is more distant from the oblong tubercle above it than in the Antillean species, and the typical form has a wider sinus on the columella, and less prominent third tooth within the outer lip. Reeve's figure of *cancellinus* (Conch. Icon. pl. 12, fig. 45) well represents the face of the shell.

The *Murex cancellinus*, attributed to Roissy by various authors, was originally described by Lamarck, the account in Sonnini's Buffon being merely a repetition. Lamarck described the shell as a Grignon fossil, but there cannot be much doubt that it was either a stray bleached example of one of the recent species or the European Miocene *D. tortuosum*. As he refers to Martini's figures, those who used the name for the recent *D. reticulata* are not without justification; but in view of the uncertainty attending it, and its later date than Link's name, it had better be placed in the synonymy. No later author has recorded *M. cancellinus*, or any *Distorsio*, from the Parisian Eocene.

D. decipiens (Rve.) is a smaller form with reddish apertural callus and a series of four short folds on the parietal wall above, in place of the two large ones of typical *reticulata*. The third tooth of the lip is prominent; the back angular as in *reticulata*. While it may turn out to be a subspecies of *D. reticulata*, the differential characters are constant in the small series examined.

²¹ I Moll. Ter. Terz. Piemonte e della Liguria, I, 231.

Distorsio clathrata (Lamarek). This is the ordinary Antillean species, and has no synonyms except the several misapplications of names really pertaining to the Eastern species, unless *Triton ridens* of Reeve belongs here, which we are unable to determine in the absence of information on its sculpture.

It differs from the Oriental species (*reticulata*) in the *evenly rounded back of the last whorl*, sculptured with regularly spaced spirals. It is not keeled at the shoulder and the lirae are not contiguous there. The two folds on the parietal wall posteriorly are much more nearly contiguous than in *reticulata*: the third tooth within the outer lip is prominent, and the columellar sinus is deep and narrow. Kiener's figures of a specimen from Lamarek's collection are characteristic. (Icon. Coq. Viv., *Triton*, pl. 14, fig. 1.)

So far as we know this species does not occur in the Miocene of Santo Domingo; but in the doubtless somewhat later Bowden Miocene a small, but otherwise practically typical race occurs, which has been figured by Guppy as "*Persona simillima* Sowb." (Quarterly Jour. Geol. Soc. XXII, 288, pl. 17, f. 13.)

Distorsia constricta (Broderip), (*Triton constrictus* Brod., P. Z. S. 1833, p. 5), is similar to *D. reticulata* in the angular back, this form is more like *D. clathrata* in the aperture. At the peripheral angle there are two *contiguous spiral cords*; below these are about ten spirals, and above them only one. The intervals between spiral cords have fine spiral striae.

The third tooth of the outer lip is enlarged; the two posterior folds of the parietal wall are rather near together, as in *Distorsio clathrata*.

The recent form belongs to the Panamic fauna. It was doubtless derived from the Antillean tertiary fauna where the stock is now extinct.

The first recognized member of the series is *D. crassidens* Conrad,²² of the Vicksburg Oligocene. This is small, and differs from the recent forms by having many unequal spiral threads and striae in the intervals between the spiral cords. Its genetic relation to the later Miocene *D. c. simillima* and the recent *D. con-*

²²*Triton crassidens* Conr., Journ. Acad. Nat. Sci. Phila. I, 1848, p. 118, pl. 11, fig. 40.

Distortrix crassidens Conr., Proc. Acad. Nat. Sci. Phila., vii, 1854, p. 31.

Distortio crassidens Conr., Amer. Journ. Conch. I, 1865, p. 20.

stricta might perhaps be expressed best by a trinomial name, *D. constricta crassidens*.

Bursa bufoniopsis Maury.

Bursa amphitrites Maury.

See: Bull. Amer. Pal. v, pp. 108, 109.

Tritonium commutatum Dkr., Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 211.

These two forms of the *B. affinis* group were not differentiated in the Gabb collection, though both are present.

Bursa crassa proavus n. subsp. Plate XXIX, figs. 4, 5.

Bursa crassa Desh., Gabb., Tr. Am. Philos. Soc. xv, p. 212.

The shell differs from *B. crassa* (Dillw.) by the broader form and more strongly developed granulation; the anal sinus is more oblique and shorter, its end is not so high as the summit of the varix behind it. The smooth embryonic shell is Naticoid, while that of *B. crassa* has a more elevated and conic spire.

Length 25, diam. 19 mm.; $3\frac{1}{2}$ embryonic and $3\frac{1}{3}$ later whorls.

Type no. 3227 A. N. S. P.

The Bowden form of *B. crassa*²³ is that which approaches the present form most closely, having similar coarse granulation; but it differs by the more conic embryonic stage, and at all stages of growth the anal canal is longer and more direct. It may be called *Bursa crassa bowdenensis* n. subsp., Pl. XXIX, fig. 8. Type no. 3747 A. N. S. P.

In the recent form the granulation is perceptibly finer, or often subobsolete on the last whorl, and another character has come in; in the most progressive examples the peripheral tubercles disappear and one or two intervariceal nodules take their place.

CASSIDIDAE.

Cassis sulcifera Sowerby.

Cassis sulcifera Sowb., Quart. Journ. Geol. Soc. vi, 47, pl. 10, fig. 7, 1849.

Gabb, Trans. Amer. Phil. Soc., xv, 222.

An ancestral form of *C. tuberosa* L., from which it differs chiefly by the smaller size and the stronger axial riblets, which almost disappear, however, in the largest adults. Sowerby's figure was from a young specimen. Old ones become triangular, in an apical view, by the predominance of a dorsal tubercle. The largest example measures:

Length 90, diam. 80 mm.

²³ *Ranella crassa* Dillw., Guppy, Q. J. Geol. Soc., xxii, p. 288, pl. 18, fig. 9.

In three peculiar specimens with hypertrophic ventral callus the width exceeds the length. They occurred in a series of 25 normal adult shells.

Cassis (Cypræacassis) testiculus (L).

Cypræacassis testiculus Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 222.

Three rather small specimens 33 to 35.5 mm. long. In one the spiral grooves appear only around the base, the axial folds being smooth.

Cassis inflata monilifera Guppy.

Cassidea granulosa Gabb, Trans. Amer. Phil. Soc., xv, 222, 1873.

Cassis monilifera Guppy, Quar. Jour. Geol. Soc., xxii, 287, pl. 17, fig. 8.

This form is almost exactly intermediate between *C. inflata granulosa* of the Antillean fauna and *C. abbreviata* of the Panamic region, and may well have been their common progenitor. It has the somewhat coronated whorls of *abbreviata*, there being two prominent granose spirals at the shoulder. The rest of the body-whorl, in the Santo Domingo shells, is granose at the intersections of narrow vertical folds with the spirals, in small examples, varying to nearly free from longitudinal sculpture in some large ones; and irregularly plicate but not granose in others. The smooth embryonic shell is perhaps a little smaller and shorter than in the Pacific *C. abbreviata*, similar to that of *C. granulosa*.

Sconsia lævigata (Sowerby)

Cassidaria lævigata Sowb., Quart. Jour. Geol. Soc., vi, 47, pl. 10, fig. 2, 1849.

Cassidaria lævigata Sowb., Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 222.

The Santo Domingo form is closely related to *S. linteæ*, a local lateral branch which left no descendants. It differs from *S. linteæ* of the Vicksburg beds only in being free from spiral sculpture in the middle, in the absence of a coronal series of slight pointed tubercles or folds, usually developed in *S. linteæ*, and in attaining a more ponderous growth. The young shells, being striate throughout, are indistinguishable. The Pliocene and Recent *S. striata* is more coarsely sculptured than any *lævigata*, and does not become so broad.

The Jamaican *S. sublævigata* is intermediate between *linthea* and *striata* in character, but nearer the latter, of which it may fairly be reckoned a subspecies.

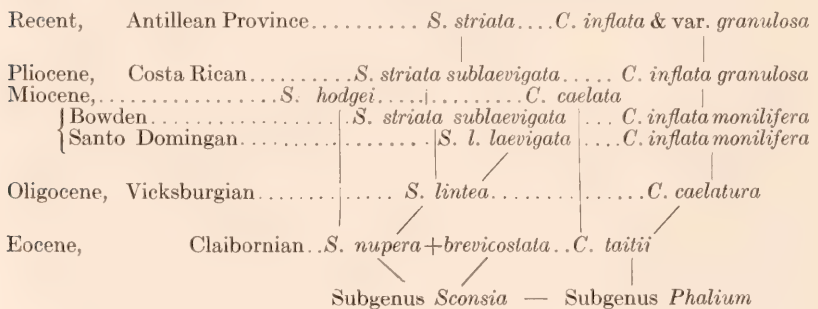
The genus *Sconsia* Gray has an interesting history in the American tertiaries, wherein both its origin and development are revealed. The series begins in the Claibornian Eocene with *S.*

nupera (Conrad),²⁴ which varies so markedly toward *Cassia* (*Phalium*) *brevicostatus* Conr., that it is evident the two are but slightly divergent mutations of a common ancestor. In *S. nupera* the denticulation of the lip and columella is but weakly developed; varices are present but not strong; the columellar callus is adnate, the siphon as much recurved as in some Eocene species of *Phalium*, and the siphonal fasciole moderately prominent. The initial whorl is smaller than in later forms, but the whole embryonic shell is more globose. A direct descendant of *S. nupera* appears to be *S. hodgei* Conr., in the Miocene of Duplin Co., North Carolina, which is modified chiefly by the loss of a convex siphonal fasciole.

A lateral branch from *S. nupera* leads to *S. lintea* Conr., of the Vicksburg Oligocene, which differs from the parent stock mainly in the more slender embryonic shell. From *S. lintea* probably arose *S. laevigata* Sowb., of the Santo Domingo beds, and *S. sublaevigata* Guppy, of the still later Bowden bed. The latter leads directly to the recent Antillean *S. striata* through the intermediate Pliocene form of Costa Rica.

Sconsia therefore branched from the *Phalium* stock of Cassididae in the early Eocene, and its progress has been marked by the reduction of the columellar callus, shortening of the anterior siphon and loss of a convex siphonal fasciole. It is not allied to *Morio*, as Fischer held.

The mutation series may be graphically represented thus:



On the right side, the ancestry of the modern *Cassia* (*Phalium*) *inflata* is indicated, but with no attempt to arrange the other species,

²⁴*Cassia nuperus* Conr., Fossil Shells of the Tertiary Formations of North America. Vol. I, no. 4, p. 46, October 1833. *Buccinum sowerbyi* Lea, Cont. to Geol. p. 164, Pl. 5 f. 169, Dec. 1833. *Semicassia nuperus* Conr., Amer. Jour. Conch. Vol. I, p. 26, 1865.

which are not known to be represented in the Santo Domingo beds. *Phalium*, in a slightly generalized form, was already well developed at the dawn of the American marine Eocene as now known; and the differentiation of the main groups of Cassididae apparently took place earlier.

Morum domingense (Sowerby)

Oniscia domingensis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 47, pl. 10, fig. 3.

Morum domingensis Sowb., Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 223.

This species is closely related to *Morum harpula* (Conr.), of the Vicksburg Oligocene, but it differs by having the expanded callus of the ventral side much less coarsely granulose, and only the peripheral row of sharp tubercles appears upon the whorls of the spire. In *M. harpula* two such rows are visible.

Length 36, diam. 22.3 mm.

DOLIIDAE.

Malea camura Guppy.

Malea camura Guppy, Quart. Journ. Geol. Soc., xxii 1866, p. 287, pl. 17, fig. 9.

Malea ringens Gabb, Tr. Am. Philos. Soc., xv, p. 223.

This is apparently distinct specifically from *M. ringens*, now living on the Pacific coast of Central America and Mexico; but *camura* undoubtedly is ancestral to the living form. The difference is more noticeable in the younger than in the adult individuals. In *M. camura* the lip is less expanded and flattened, and has a uniform slope toward the interior. The callous projection on the parietal wall is always bilobed, not trilobed as in *ringens*; the columellar prominence consists of a large bifurcate tooth with a smaller one below it, the latter usually distinctly separated from the former.

Guppy's type is a young shell, but all of the Jamaica specimens seem to be much smaller than the larger ones of Santo Domingo and Gatun. Santo Domingo examples measure:

Length 71, diam. 55 mm., $4\frac{1}{2}$ post-embryonic whorls.

Length 27.5, diam. 20.5 mm., $2\frac{3}{4}$ post-embryonic whorls.

In specimens of all sizes, the furrows are nearly or quite as wide as the spiral ridges, thus differing from the two forms following. 62 examples in the Gabb collection.

Malea elliptica Pils. and Johns. Plate, XXIX, fig. 3.

Proc. A. N. S. Phila., 1917, p. 169.

Malea goliath Pils. and Johns. Pl. 29, figs. 1, 9.

Proc. A. N. S. Phila., 1917, p. 170.

Probably *Malea sp. indet.* Maury, Bull. Amer. Pal., V, p. 113.
The figures are much reduced in size

***Pyrula pilsbryi* B. Smith.**

Ficus papyratia Say, Gabb, Tr. Am. Philos. Soc., xv, p. 223.

Pyrula pilsbryi Smith, Proc. A. N. S. Phila. 1907, p. 213.

Dr Smith has indicated the differential characters of this species.

***Pyrula carbacea* Guppy.**

Ficus mississippiensis Gabb, Tr. Am. Philos. Soc., xv. Not of Conrad.

Pyrula carbacea Guppy, Q. J. Geol. Soc., xxii, 1876, p. 580, pl. 26, fig. 7.

Although Guppy (Quart. Jour. Geol. Soc. xxxiii, 525) subsequently considered his species a synonym of *Pyrula mississippiensis*, he probably did not actually compare specimens. The two species agree closely in sculpture, the prominent revolving carinae being slightly wider apart in *P. carbacea* than in *P. mississippiensis*. The chief difference however is in the apical whorls. *P. carbacea* has only one smooth, blunt uptilted embryonic whorl, while *P. mississippiensis* shows $2\frac{1}{2}$ or 3 regular smooth whorls. Dr. Burnett Smith has illustrated the embryonic whorls of *P. mississippiensis* in Proc. A. N. S. Phila., 1907, pl. XVII, fig. 5.

One specimen in the Gabb collection, somewhat broken, measures:
Length 29, diam. 13 mm.

CYPRAEIDAE.

***Cypraea dominicensis* Gabb. Plate XXX, figs. 7, 8.**

Cypraea dominicensis Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 235.

The type has the form of *C. lurida*, being a little produced at both ends. There are 36 teeth on the outer lip, 29 on the inner.

Length 39.5, lateral diam. 23.2, dorso-ventral diam. 19 mm.

Type is no. 3003 A. N. S. P.

***Cypraea cinerea* Gmelin.**

We refer one of the specimens included by Gabb in *C. dominicensis* to this recent species.

***Cypraea isabella* Linné (*patrespatriæ* Maury)**

Cypraea isabella L., Gabb, Tr. Am. Philos. Soc., xv, p. 235.

Two specimens, which present no characters differing from the recent shells. The larger one closely resembles a recent *C. isabella mexicana* Stearns which we compared.

Cypraea henekeni Sowerby.

Cypraea henikeri Sowerby, Q. J. Geol. Soc., vi, 1849, p. 45, pl. 9, fig. 3.

Cypraea henekeni Sby., Gabb, Tr. Am. Philos. Soc., xv, p. 235.

Cypraea henikeri Sowb., var., Brown and Pilsbry, Proc. A. N. S. Phila. 1911, p. 356, pl. 26, figs. 9, 10.

This species resembles the recent *C. mus*, and has parallel variations, both having smooth and bicornute or bituberculate forms. In *C. henekeni* the tuberculate form predominates, and the tubercles are larger, being thus more specialized than the modern race of the same stock. It has been well figured by Sowerby. A variety occurs in the Gatun bed.

Length 38 to 66 mm.

Cypraea spurcoides Gabb. Plate XXX, figs. 4, 5.

Cypraea spurcoides Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 235.

Gabb has compared it with *C. spurca*, but of recent species it seems to us closest to large examples of *C. annulus* in shape.

Length 32.8, diam. 20.3 mm. Type no. 2999 A. N. S. P.

Length 24, diam. 15.7 mm.

Cypraea raymondrobertsi n. sp. Plate XXX, figs. 1, 2, 3.

The shell is subovate in basal outline, solid, with the sides heavily calloused, laterally angular, the callus rising high, especially on the left side, and covering the spire, which is marked by a shallow irregular pit. Ends but little produced. The outer lip has 19 strong teeth, narrower than their intervals. Inner lip with 17 teeth. The base is rather strongly convex.

Length 27, lateral diam. 19.2, dorso-ventral diam. 14.9 mm.

Somewhat like *C. arabicula* Lam. by its angular sides, the aperture as in *C. albuginosa* Mawe.

Type no. 3995 A. N. S. P.

In the Bowden bed there is a form similar in having angular lateral calluses, but differing by having fewer teeth, 16 and 13 on the outer and inner lips respectively. They extend further upon the base, which is less convex. Length 25.5, width 17.3 mm. This form may be called *Cypraea raymondrobertsi bowdenensis* (Pl. XXX, fig. 6).

Type no. 11146 A. N. S. P.

Cypraea spurca Linné.

A series of six. We find no character to differentiate them from recent shells.

Cypraea campbelliana n. sp. Plate XXX, figs. 9, 10.

The shell is oblong-oval, but slightly produced at the ends, mod-

erately calloused laterally, the callouses dappled with rather small dark spots; dorsal outline evenly arched, spire concealed. Outer lip having 24 teeth. Inner lip with 20 short teeth, not running inward as in *C. cinerea*. In the lower part of the columella an inner series of 5 short teeth may be seen.

Length 30.3, lateral diameter 18.7, dorso-ventral diam. 15 mm.

It is less convex than *C. cinerea*, the posterior slope of the dorsal outline less abrupt. Moreover, the markings of the lateral callouses seem to be of a different character. The teeth are far less numerous than in *C. dominicensis*. Named for Mr. John Campbell, an enthusiastic student of the Cypraeidæ.

The type and three other specimens are no. 3000 A. N. S. P.

Pustularia gabbiana (Guppy)

Pustularia nucleus Linn., Gabb, Trans. Amer. Philos. Soc., xv, p. 236. Not

Cypraea nucleus L.

Cypraea gabbiana Guppy, Q. J. Geol. Soc., xxxii, 1876, p. 528, pl. 29, fig. 10.

While this species has a general resemblance to *P. nucleus* L., it differs by the following characters: the raised transverse lines which net the tubercles together are more numerous and conspicuous; the tubercles along the lateral margins are larger; the transverse ridges of the base alternate in size, but the smaller ones terminate at the margin of the aperture in teeth equal to those terminating the larger ridges; the teeth of the columellar side do not extend entirely within the aperture, but end on a sort of projecting ledge, inward from which a latticed-granulose sculpture is seen. Finally, the aperture curves more to the left at the upper end.

Length 15.4 to 20.2 mm.

STROMBIDAE.

Strombus haitensis Sowerby.

Strombus haitensis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 48, pl. 9, fig. 7.

Strombus bituberculatus Lam. in part, Gabb, Tr. Am. Philos. Soc. xv, p. 233.

While this may be an ancestor of *S. bituberculatus*, there are considerable differences. The spire is much higher, and the spiral striation differs.

Strombus galliformis Pils. and Johns. Plate XXXI, figs. 1, 2.

Proc. A. N. S. Phila., 1917, p. 170.

Compare *S. maoensis* Maury, which may be the same. It has a shorter spire, and the lip appears to be unknown.

Strombus dominator Pils. & Johns. Pl. XXXII, figs. 1, 9.

Proc. A. N. S. Phila., 1917, p. 171.

A very large Stromb, approaching *S. gigas* in size.

***Strombus ambiguus* Sowerby,**

Strombus ambiguus Sowerby, Q. J. Geol. Soc. vi, 1849, p. 48.

Strongly sculptured spirally, narrower than *proximus* with less developed spines. There are several strong wrinkles on the columellar lip posteriorly.

***Strombus ambiguus* form *bifrons* Sowerby**

Strombus bifrons Sowb., Q. J. Geol. Soc., vi, 1849, p. 48, pl. 9, fig. 9.

This form or incipient race, becomes somewhat larger than typical *ambiguus*; the tubercles of the penult whorl are larger and less numerous. It is therefore a more advanced form, in the acceleration of this sculptural feature forming a transition to *S. proximus*. It has not the posterior wrinkles of the columellar lip of typical *S. ambiguus*, and the outer lip is smooth or nearly so within. The external spiral sculpture is strongly developed.

Length 66, diam. 42. mm.

***Strombus proximus* Sowerby.**

Strombus proximus Sowerby, Q. J. Geol. Soc., vi, 1849, p. 48, pl. 9, fig. 8.

Strombus pugilis L., Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 233.

In this extremely abundant form, the penult whorl bears fewer and larger tubercles or spines than in *S. a. bifrons*. In the prevalent form of the race they are larger than on the last whorl. There is almost invariably an inferior series of tubercles on the left side or very rarely continuing to the lip. Typically the surface is spirally striate; but there are transitions to the form having spirals at the base only. The lip is either rugose or almost plain within. The presence of wide, rounded variceal swellings on the antepenult whorl appears to be variable. The maximum length is about 75 mm., but 55 to 60 mm. is more usual.

***Strombus proximus pugiloides* Guppy.**

Strombus fragilis Moore, Q. J. Geol. Soc., xix, p. 511.

Strombus pugiloides Guppy, Geol. Mag. 1874, p. 433.

The earliest form of this race appeared in the Santo Domingan formation in a form smaller than most *proximus*. The spines have disappeared from the last whorl or half-whorl, and spiral striae are only at the base. The interior of the lip is either smooth or rugose. There are sometimes traces of tubercles of an inferior series. These specimens are transitional between *proximus* and *pugiloides*.

The typical form of *pugiloides* is that of Bowden. It often shows rufous chevrons on the back, and has invariably a smooth lip. An

inferior series of tubercles is never developed. It is also somewhat larger than most Santo Domingan examples.

S. p. pugiloides may be the ancestor of *S. pugilis*, or perhaps it is not in the direct line. *S. pugilis* appears in its typical form in the Pliocene of Florida and Costa Rica

Strombi of the *proximus*-group are abundant shells in the Santo Domingan beds. There are about 150 specimens in the Gabb collection.

As a whole, the series differs from *S. pugilis* and its varieties by having the peripheral series of spines (or when spines are wanting, the rounded shoulder) situated lower on the back of the last whorl, the slope above it longer relative to that below it. This differential character is invariable. Also by the tendency to have an inferior series of tubercles. These may be much reduced, or, in some individuals wanting, yet there is never any trace of them in *S. pugilis*. It appears to us that the evolutionary changes of the stock are lost sight of if the forms *ambiguus*, *bifrons*, *proximus* and *pugiloides* are submerged as synonyms of *S. pugilis*. Nothing with the characters of the recent *S. pugilis* has been found in the Santo Domingan or Bowden beds.

Orthaulax inornatus Gabb. Plate XXX, figs. 13, 14, 15.

Orthaulax inornatus Gabb, Proc. A. N. S. Phila. 1872, p. 273, pl. 9, fig. 3, 4, (Feb. 11, 1873). Tr. Am. Philos. Soc., xv, p. 234. Guppy, Q. J. Geol. Soc., 1876, p. 520, pl. 28, fig. 8. Dall, Bull. U. S. Nat. Mus. No. 90, p. 86, pl. 11, fig. 4. Proc. U. S. N. Mus. LI, 1916, p. 509, pl. 88, fig. 9.

Gabb selected a specimen of medium size for type (his fig. 3, our Pl. XXX, fig. 15). The callus envelopes the spire but does not cover the apex. There is a low longitudinal callous swelling in front of the posterior end of aperture and extending up the spire, and a somewhat more distinct one opposite this on the left side, becoming dorsal on the spire. The shell is thus somewhat compressed dorso-ventrally. Anteriorly there are rather weak spirals.

Length 55, diam. 27, dorso-ventral diam. 21.7 mm.

The largest specimen (Pl. XXX, fig. 14) is injured at the apex and shows no calluses, the outline seen from above being regular, not it flattened dorso-ventrally.

Length 91.3, diam. 41.7 mm.

In a young example (Gabb's fig. 4, our Pl. XXX, fig. 13) the suture has begun to rise at the beginning of the tenth whorl. The ninth has callous swellings on each side, and is therefore a little flattened between face and back. The cavity is also somewhat narrow-

ed within the last swelling. The whorls of the spire show low, rounded varices, two or three on each after the first three or four. This specimen is 30.2 mm. long with 9 whorls and a small part of the tenth above.

Dall's figure of a fragment of the spire shows a somewhat greater apical angle than either of Gabb's specimens.

Orthaulax inornatus altilis n. subsp. Pl. XXX, figs. 16, 17, 18.

Four of Gabb's specimens differ from the above by the shorter spire. Possibly they intergrade with the typical form, as this is not a character of much constancy in Strombidae; but in the absence of evidence on this point it may be well to notice this form. Pl. XXX, figs. 17, 18 represent the largest example. The apex is wholly covered. There is a longitudinal callous hump on the left side opposite the aperture; but as the lip is broken back the hump appears to be dorsal. There are faint traces of a few spirals towards the base.

Length 52, diam., 28 mm., antero-posterior diam. 29.5 mm.

A young example of 9 whorls, 27.5 mm. long. (Plate XXX, fig. 16), is similar to the young shell described under *O. inornatus* except that the spire is shorter, with fewer varices on the whorls. The last whorl is wider and has not begun to ascend. The lower half of the last whorl has numerous (about 17) spiral grooves defining rather flattened cords.

Type no. 4065 A. N. S. P.

TRIPHORIDAE.

Triphora nigrocincta C. B. Adams. (?).

Triphoris nigrocinctus? Adams, Gabb, Trans. Amer. Philos. Soc., xv, p. 239.

We can add nothing to Gabb's note on the single young specimen of this form. It at least indicates a species of the *perversa* group and is probably identical with *Triforis calypsonis* Maury.

CERITHIIDAE.

Cerithium microlineatum Gabb. Plate XXXII, figs. 2, 3.

C. microlineatum Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 236.

The upper whorls show small irregular axial folds. The later ones have a series of low nodes below the suture and fine unequal spirals, part thread-like, part wider, the principal ones granulose. The last whorl has one low, broad varix, the earlier ones rather numerous varices at irregular intervals.

Length 50, diam 18.5 mm. (Type).

It seems to have reached a length of about 60 mm. or more. Resembles somewhat the figure of *C. caloosaense* var. *heilprini* Dall, of the Floridian Pliocene.

Type and nine other specimens no. 2597 A. N. S. P.

Cerithium turriculum Gabb. Plate XXXIII, figs. 1, 2, 8..

C. turriculum Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 238.

Sculpture of strong axial folds, angular at the shoulder, on the median whorls; earlier whorls have lower folds, not angular, and the last whorl has very short folds next the suture. Spiral striation of unequal threads. The broken type specimen figured is 24 mm. long, and has twelve folds on the last whorl.

The sculpture varies a good deal among the 23 examples.

This is probably an ancestral form of the more robust *C. moenensis* Gabb, from the Pliocene of Costa Rica.

Type no. 4067; 22 other specimens no. 4068 A. N. S. P.

Cerithium dominicense Gabb. Plate XXXIII, figs. 3, 4.

Cerithium dominicense Gabb, Tr. Amer. Philos. Soc., xv, 1873. p. 328.

The last $2\frac{1}{2}$ whorls have prominent rounded tubercles below the suture, about 9 on a whorl. Below these there are about 6 tuberculiferous cords on the last whorl, with finer, unequal threads in their intervals. The earlier whorls have axial folds crossed by 4 or 5 principal spiral cords; at first every third fold is somewhat larger, then every fourth; but on the last three whorls such variceal folds do not appear. None of the specimens has a perfect aperture.

Length 25.7, diam. about 11 mm.

Type and three other specimens no. 2594 A. N. S. P.

Cerithium uniseriale Sowerby. Plate XXXIII, figs. 16, 20.

Cerithium uniseriale Sowerby, Q. J. Geol. Soc., vi, 1849, p. 51. Not of Guppy.

One specimen, broken at the aperture, has the characters called for by Sowerby's diagnosis. It is related to *C. obesum* Gabb, but there is a band of low tubercles below the suture, separated from the principal series by a depression, and the spiral striation is coarser, uneven, with some weakly granose spirals.

We believe that Gabb's identification of this species is correct. Guppy's interpretation (Q. J. Geol. Soc., xxxii, pl. 29, fig. 4) is not in accord with Sowerby's diagnosis. It is *C. obesum ventricosior*. *C. obesum* of Guppy, tab. cit. f. 9, may be a young *C. simplex* Gabb, though this is not certain.

C. uniseriale is an obesely conic shell. There is an infra-sutural series of rather short axial folds, interrupted by a spiral depression or concavity, the folds stronger below it. On the last whorl the folds are smaller than on the penult. About every fourth or fifth fold is stronger on the penult whorl. The surface is rather finely striate spirally, and on the last whorl there are several low cords which are weakly tuberculate, and there is a variceal swelling opposite the aperture. The last half whorl is broken away. There is a strong callous ridge at the posterior part of the inner lip, as in *C. obesum*. As broken the single specimen (no. 2595) measures, length 23, diam. 11 mm.

This form stands near *C. obesum*, but differs by the impression below the suture and the coarser spirals of the last whorl.

***Cerithium obesum* Gabb.** Plate XXXIII, figs. 5, 6.

Cerithium obesum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 237.

Gabb's description is somewhat elastic, drawn to cover several forms which he included under *obesum*, but several phrases apply to only one specimen of the type lot: "Outer lip effuse, internally thickened. Length 1 inch, diameter .5 inch" "expanded lip". These phrases must have had in view the specimen shown in our plate XXXIII, figs. 5, 6, since this is the only one in the lot which retains any part of the outer lip, and agrees in size. It measures 24 mm. long, 12.5 wide, aperture 11.8 mm. long. The last whorl rises conspicuously in its last third. The last three whorls have rounded tubercles below the suture, very small and weak on the antepenult. The whole surface is covered with a fine, nearly even spiral striation. Eight whorls are present, the apex being slightly worn. The basal part of the lip is broken.

Type no. 2596 A. N. S. P.; some 13 immature or broken examples, varying in tuberculation, are no. 2596 a.

***Cerithium obesum ventricosior* n. var.** Plate XXXIII, figs. 9, 10, 11, 12,

Cerithium uniseriale Guppy, not Sowerby.

The shell differs from *C. obesum* by the wider angle of the spire and relatively large last whorl. This obese form is represented by numerous examples, all having the last third or half of the last whorl broken away. It seems to be what Guppy has figured as *C. uniseriale* Sowb.²⁵

²⁵ Quart. Jour. Geol. Soc. xxxii, pl. 29, fig. 4. Maury, Bull. Am. Pal., 29, p. 124, pl. 21, figs. 14, 15.

The infrasutural tubercles are seen on two to four whorls, but they are very weak except in the last whorl, or sometimes the last two. They may disappear for a half whorl, to reappear later. In some examples there are only weak traces of tubercles, and these appear to form a transition to *C. gurabense* Maury. In all there is a minute but distinct spiral striation, either nearly even, or sometimes about every eighth thread is slightly larger.

Length as broken 27, diam. 13 mm. Type no. 4074, figs. 10-12.

Length as broken 26, diam. 11.5 mm. Fig. 9.

The loss of the last half whorl makes the diameter much less than in a perfect shell.

A peculiar specimen, no. 4075, in which the last whorl is rather short and rounded, and the subsutural tubercles very small, is photographed in Plate XXXIII, figs. 18, 19. It is a young shell, perhaps referable to *C. o. ventricosior*.

Length 25, diam. 13 mm.; 8 whorls.

Cerithium obesum harrisi n. var. Plate xxxiii, figs. 14, 15.

A variety which may be called *harrisi*, was found among unasorted shells. It seems to be a degenerate form, perhaps from an unfavorable station. It is smaller, narrower, covered with slightly unequal spiral striae; there are about 6 tubercles on the back of the last whorl. The suture rises steeply towards the aperture.

Length 22, greatest diam. 9.4, antero-posterior diam. 7.6 mm.; $10\frac{1}{3}$ whorls.

Type no. 4073 A. N. S. P.

Cerithium (obesum?) gurabense Maury. Plate xxxiii, figs. 13, 17.

In another form the size is about the same as the last, but alternate threads are granose. On the last whorl there are infrasutural tubercles, on those preceding, two series of enlarged granules. This appears to be *C. gurabense* Maury.

Length as broken 20 mm.; diam. 7.5 mm.

Cerithium simplex Gabb. Plate xxxiii, fig. 7.

Cerithium simplex Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 238.

? *Cerithium obesum* Gabb, Guppy, Q. J. Geol. Soc., xxxii, 1876, p. 519, pl. 29, fig. 9. Not of Gabb.

A species of simple, conic form, without varices on the later whorls, though some very low, inconspicuous ones may be seen on the upper. It is spirally grooved, the intervals slightly convex and very unequal, not in the least granose.

The aperture is broken. Columella concave, truncate at base. *No callus on the inner lip above.* An isolated species.

Length 26, diam. 12.7 mm.; $8\frac{1}{2}$ whorls remaining.

Type and five others, no. 2604 A. N. S. P.

Cerithium (?) venustum Gabb. Plate XXXII, fig. 4.

? *Cerithium venustum* Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 238.

Sculpture of numerous axial folds, tuberculate at the intersections of three low, equal spiral cords, and a narrower one close below the suture. There are some spiral threads between the cords. There are low, rounded varices on the last six whorls, all being on one side of the shell, one varix on a whorl.

The type, no. 2598 A. N. S. P., is broken at both ends. No other specimen was found.

Length 29, diam. 7 mm.; $10\frac{1}{2}$ whorls remaining.

Gabb questioned the genus. It is perhaps impossible without the aperture to define its relations.

Clava plebeia (Sowerby)

Cerithium plebeium Sowerby, Q. J. Geol. Soc., vi, 1849, p. 51, Guppy, xxii, 1866, p. 290, pl. 16, fig. 9 (not good).

An abundant species, perhaps ancestral to the West American *C. gemmata* (Hinds).

Clava has been placed between *Drillia* and *Mangilia* in Bull. Amer. Pal. V, p. 57.

Potamides haitensis (Dall)

Pyrazisinus ? haitensis Dall, Proc. U. S. Nat. Mus. xix, p. 319, pl. 29, fig. 8.

A single mutilated specimen. No. 3197 A. N. S. P.

Potamides prismaticus (Gabb). Plate XXIX, fig. 12.

Cerithium prismaticum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 236.

Represented by one imperfect shell, no. 2601 A. N. S. P., measuring, length 57.3, diam. 28 mm. It is well distinguished by the short, heavy ribs or nodes and the deep, "square-cut groove below the suture". Length of the broken specimen 57.3 mm.

Potamides suprasulcatus (Gabb) Plate XXIX, figs. 10, 11.

Cerithium suprasulcatum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 236.

Potamides ormei Maury, Bull. Amer. Pal. v, p. 126.

The early whorls have three spiral ridges cut into granules by longitudinal sulcations (fig. 10). The space between the upper and the second spiral ridge is deeper than the other spaces, and on the later whorls it becomes a deep, square-cut furrow, defining the su-

tural cingulus. It is this stage which Miss Maury described as *P. ormei*. The longitudinal sulcations disappear on the last two or three whorls, which are not granose. The base has several shallow spiral grooves.

Length 29.5, diam. 17.3 mm.; 5 whorls remaining.

Type and 13 others no. 2600 A. N. S. P.

All of the 14 specimens have been more or less rolled and worn, probably indicating that we have to do with an estuarine snail which had been washed out into the beds of marine deposition.

Potamides roumaini Pils. (Proc. A. N. S. Phila., 1910, p. 487, from between Las Caobas and Hinche, Haiti, W. W. Webster and Edmond Roumain) is a smaller and narrower species than *P. supra-sulcatus*, with stronger spiral sculpture. Length 24, diam. 13 mm. Type no. 1314 A. N. S. P.

Potamides caobasensis Pilsbry.

Potamides caobasensis Pils. Proc. A. N. S. Phila. 1910, p. 488.

The shell is smooth, the whorls prominent below the suture. Length (broken) 23 mm. Type no. 2603 A. N. S. P. Not collected by Gabb.

Potamides dentilabris (Gabb) Plate XXIX, figs. 6, 7.

Cerithium dentilabre Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 237.

This shell resembles the East Indian *P. palustris* (L.). There are four spiral cords about equal to their intervals running over small axial folds and an occasional rounded varix about double the size of the folds. Coincident with the varices, two lip-teeth are formed internally, and there is also a callous fold on the parietal wall. Columella has a strong oblique plait. Probably none of this armature would be visible in an entire adult shell, but it is exposed in the fossils, most of which are broken back to the last varix. All have been rolled, and probably were washed out of a lagoon or estuary.

Length 49.5, diam. 21 mm.; 8 whorls remaining.

Type and six other specimens no. 2502 A. N. S. P.

Potamides gastrodon Pils. and Johns. Plate XXXII, figs. 5, 6.

Proc. A. N. S. Phila., 1917, p. 171.

This species differs from *P. transecta* Dall, of the Tampa Siliceous bed, in details of sculpture, having three instead of four main spirals on each whorl, nodules at the intersections of the axial riblets, and a very prominent varix on the left of the last whorl. The type has a weak thread dividing the spiral interstices on the last whorl. In other specimens of the lot these secondary spirals are well developed.

Bittium yaquense (Gabb) Plate XXXV, fig. 12.

Cerithium yaquensis Gabb, Trans Amer. Philos. Soc., xv, 1873, p. 238.

There are about two varices on a whorl. On the spire there are vertical rounded ribs between the varices, but these disappear on the last one or two whorls. The whole shell is spirally striate. Inside there are short spiral lirae within the varices.

Length 10, diam. 3.8 mm.; 9 whorls remaining.

Length 9, diam. 3.1 mm.; 11 whorls.

Type no. 2619 A. N. S. P.

The type figure is from a shell not quite mature. Most of the specimens are either immature or somewhat broken.

Bittium asperoides Gabb. Plate XXXV, fig. 4.

Bittium asperoides Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 239.

There are four spiral threads on each whorl, with another visible in the suture, and on the last two whorls traces of one or two faint ones between the major threads. Base with six equal spiral threads. On the penult whorl there are 15 axial ribs, counting the two varices.

Length 4.1, diam. 1.4 mm.; aperture 0.85 mm.; 11 whorls.

Type no. 2616 A. N. S. P. It is an abundant species.

In a form which we take to be a variety (var. *asperandum*) there are more spiral threads, 8 between sutures, and slenderer, more numerous and more arcuate ribs, about 19 on the penult whorl. Length 2.8, diam. 0.95, aperture 7 mm.; 11 whorls.

Type no. 3100 A. N. S. P.

Alabina canaliculata (Gabb) Plate XXXV, fig. 2.

Bittium canaliculatum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 239.

Shell imperforate, rather thin, turrited. The sculpture consists of even, rounded, backwardly arched ribs which scarcely pass over the periphery of the last whorl, the base being sculptured with about seven spiral cords, the lower ones very weak. The suture is very deeply impressed, the channel mentioned by Gabb being extremely narrow. In the type specimen there is a low varix at the beginning of the last whorl. Columellar margin reflected above.

Length 3.3, diam. 1.25 mm.; aperture 0.85 mm.; 10 whorls.

Length 4.6, diam. 1.6 mm.; $10\frac{1}{2}$ whorls. (Type).

Type no. 2618 A. N. S. P.

Bittium (*Styliferina*) *cerithioides* Dall, differs from this species by its carinate upper whorls.

In some of the specimens one or two weak spiral cords may be

seen below the suture, or even very faintly in the intercostal spaces over the whole last whorl, about 6 above the periphery. In the type and most others the ribbed portion shows no spirals.

Alabina angustior n. sp. Plate XXXV, fig. 3.

The shell is decidedly narrower, with fewer axial ribs, about 14 on the last whorl. Base with about 6 spiral cords, the lower ones very weak. Otherwise like *A. canaliculata*.

Length 3, diam. 1 mm.; 10 whorls.

Type no. 4062 A. N. S. P.

LITIOPIDAE.

Alaba maoensis (Gabb) Plate XXXV, fig. 11.

Cerithium maoensis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 239.

The type has lost the tip of the spire, and the last whorl is broken. The whorls are strongly convex, with sculpture of grooves separating low, convex spirals, about 13 grooves on the penult whorl. There is a broad rounded varix on each whorl.

Length 10, diam. 4.7 mm.; nearly 9 whorls remaining.

Type no. 2617 A. N. S. P.

MODULIDAE.

Modulus sp. undet.

This genus is represented by a young shell 6 mm. in diameter, and a fragment of the spire of another. They differ from *M. catenulatus* by wanting the low radial plications of that species. It is evidently close to *M. wilcoxi* Dall, of the Chipola beds, but there are some differences, and without adult shells a positive identification cannot well be made.

VERMETIDAE.

Serpulorbis papulosus (Guppy)

Vermetus papulosus Guppy, Q. J. Geol. Soc., xxii, 1866, p. 292, pl. 17, fig. 3.

Thought by Gabb to be the straight portion of *Petalocochnus domingensis*; but some of the specimens show that the early whorls are very irregularly contorted. The straightened part has three striae between the rows of pustules, the central one larger. The largest tube has a diameter of 10.5 mm.

Vermetus (Petalocochnus) laddfranklinæ (Maury)

The lower whorls are very irregularly coiled, circular in section.

No internal septa were seen in these specimens. The erect, nearly straight portion is cylindric, and has about 12 spiral ridges, and close, fine circular striae. Diameter 4.5 mm. A larger specimen with more slowly revolving spirals has a diameter of 5.2 mm. No. 2812 A. N. S. P. It was referred to *V. decussatus* Gmel., by Gabb (*l. c.* p. 240).

Vermetus (*Petalococonchus*) *domingensis* Sowb.

Petalococonchus domingensis Sowb., J. Geol. Soc. Lond., vi, 18, p.51, pl. 10, fig. 9.

Petalococonchus sculpturatus H. C. Lea, Gabb, Tr. Am. Philos. Soc., xv, p. 240.

This is the most abundant species of the family in Gabb's collection. We think it a subspecies of *V. sculpturatus* Lea.

TURRITELLIDAE.

***Turritella perattenuata praecellens* Pils. and Brn.**

Turritella perattenuata praecellens P. and B., Proc. A. N. S. Phila. 1917, p. 36, pl. 5, fig. 12.

Turritella tornata Guppy, in part, Gabb, Tr. Am. Philos. Soc., xv, p. 240
Not of Guppy.

The type (broken) and parts of two other specimens are no. 2608 A. N. S. P.

***Turritella tornata* Guppy.**

Turritella tornata Guppy, Q. J. Geol. Soc., xxii, 1866, p. 580, pl. 26, fig. 12
Gabb, Tr. Am. Philos. Soc., xv, p. 240, (in part).

Seventeen specimens, more or less imperfect, represent this species. Guppy's figure is from one of the most distinctly granose examples.

***Turritella calostemma* Pilsbry and Brown.**

Turritella calostemma P. and B., Proc. A. N. S. Phila., 1917, p. 36, pl. 5, fig. 15.

Between Las Caobas and Thomonde, Haiti; not yet found in Santo Domingo.

Type no. 2610 A. N. S. P.; also no. 2609.

***Turritella megalobasis* Dall.**

Turritella exoleta Linn., in part, Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 240.

Turritella megalobasis Dall, Pilsbry and Brown, Proc. A. N. S. Phila., 1917
p. 36, pl. 5, fig. 14.

A broken specimen 42.5 mm. long, of somewhat over 4 whorls, has a basal diameter of 20.4 mm. The last whorl has a peculiar sculpture, figured by Pilsbry and Brown.

Turritella domingensis Pilsbry and Brown.

Turritella domingensis P. and B., Proc. A. N. S. Phila. 1917, p. 35, pl. 5, figs. 7, 7a, 9.

Turritella exoleta Linn., in part, Gabb, *l. c.*

Type and parts of six smaller specimens are 2611 A. N. S. P.

Turritella sulcigyrata Pils. and Johns. Plate XLII, fig. 15.

Proc. A. N. S. Phila., 1917, p. 171

CAECIDAE.

Cæcum (Meioceras) constrictum Gabb. Text-fig. 17.

Cæcum constrictum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 241.

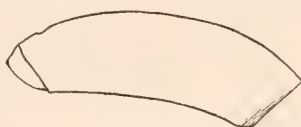


Fig. 17. *Cæcum constrictum*.

The smooth shell is not much arched, has a prominent, irregularly dome-like plug, and is decidedly contracted at the aperture which is not very oblique.

Length 2.05, greatest diam. 0.6 mm.

Type no. 3017 A. N. S. P.

This species differs from *C. nitidum* Stimps. by the far less oblique aperture. The single specimen is evidently adult.

Cæcum anellifer Pils. and Johns. Text-fig. 18.

Proc. A. N. S. Phila., 1917, p. 172.

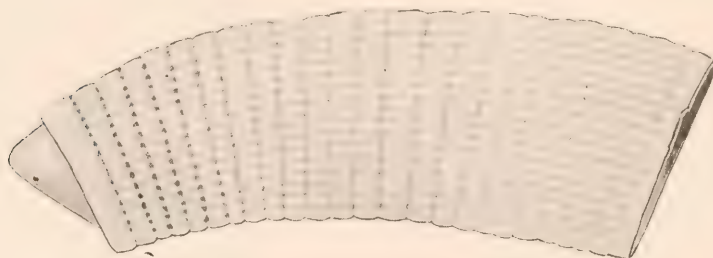


Fig. 18. *Cæcum anellifer* P. and J.

MELANIIDAE.

Hemisinus truncatus (Gabb) Plate XXXIV, figs. 14, 15, 16.

Ectracheliza truncata Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 214; Proc. A. N. S. Phila. 1872, p. 271, pl. 9, fig. 2. (Feb. 11. 1873).

Specimens in good condition show more or less minute, weak spiral striation, such as may be traced in the smoother recent species. Traces of color bands, somewhat wider than in the recent Cuban *H. ornatus*, can be made out on some examples. As in many of the melanians, the spire is extensively truncated, often leaving little more than the last whorl. The shell is larger than any recent Antillean *Hemisinus*, and further differs by the shorter spire and long last whorl, characters which may possibly give *Ectracheliza* standing as a "section" of *Hemisinus*; yet it belongs unquestionably to that genus. The largest example measures, length 36.4, diam. 24 mm. The author has elsewhere alluded to the evidence for Antillean land areas afforded by the Oligocene (or Miocene) freshwater shells (*Nautilus* XXVIII, p. 84).

Type and 8 others, no. 2878 A. N. S. P.

ARCHITECTONICIDAE.

Solariidae of authors.

Architectonica quadriseriata (Sowb.)

Solarium quadriseriatum Sowb, Journ. Geol. Soc., Lond., vi, 1849, p. 51, pl. 10, figs. 8a, b, c.

Sowerby's figures represent a half grown example. It reaches a diameter of 37 mm.

Torinia rotundata Gabb. Plate XXXIV, figs. 18, 19, 20.

Torinia rotundata Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 228.

There are two spiral cinguli at the periphery, with an intermediate thread, the upper cingulus somewhat wider and prominent. Above it there are four flat cinguli, the upper one narrowest, with fewer granules. Several preceding whorls show five spirals. Under the lens delicate spiral striae are seen upon them. On the base there are five cinguli, the outer one narrowest, with a thread in the grooves on each side of it. The inner cingulus is toothed around the umbilicus, within which two cords and one or two threads run on the last whorl. The whole surface is closely ribbed radially, the riblets more prominent on the cinguli than in their intervals.

Alt. 9.6, diam. 13.5 mm.; 6 whorls.

The holotype is no. 2816 A. N. S. P.

RISSOIDAE.

Not many members of this family are in the collection. Gabb had no luck with his classification of the few obtained, the species of *Rissoina* being referred to four genera. The new genus *Iopsis* was based upon the young stage of a *Rissoina*.

The Rissoinas of the Santo Domingan Miocene seem to have changed very little since that time, all of those known being identical with, or very closely related to, modern species of the same region.

The genus *Crepidacella* Guppy, 1867 (+*Dolophanes* Gabb, 1873) is closely related to *Rissoina*, but may be held distinct by the simple lip, which is sharp, without any trace of the external varix which strengthens the lip of *Rissoina*. Otherwise it has essentially the structure of *Rissoina*.

Crepidacella cepula (Guppy) Plate XXXIV, figs. 12, 13.

Melanopsis capula Guppy,²⁶ Quart. Journ. Geol. Soc., xxii, 1866, p. 580, pl. 26, fig. 14. (*Melanopsis cepula* on p. 590).

Crepidacella cepula Guppy, Geol. Mag. iv, 1867, p. 500,; Quart. Journ. Geol. Soc., xxxii, 1876, p. 524.

Dolophanes melanoides Gabb, Proc. A. N. S. Phila., 1872, (1873), p. 273, pl. 11, fig. 7; Trans. Amer. Philos. Soc., xv, p. 235.

Pleurotoma (Mangilia) columbella Dall, Bull. M. C. Z. ix, 1881, p. 60.

Pleurotoma (melanoides var.?) columbella Dall., Rep. "Blake" Gastrop. 1889, p. 271.

Dolophanes (melanoides Gabb, var.) *gabbii*, Dall, Rep. "Blake" Gastrop. 1889, p. 270, pl. 29, fig. 7.

As the affinities of this snail have been variously estimated by the conchologists who have considered it, some statement of the changes of opinion may not be out of place. *Melanopsis capula* (*cepula*) was described from a formation thought to be Upper Miocene, at Cumana, Venezuela. Mr Guppy says:

"I do not know of any form resembling this species, which was probably not a freshwater shell. It may possibly have been an estuarine form. It reminds one of a shortened and widened *Eulima*, or even a *Stylifer*."

In forming the new genus *Crepidacella* for the species, in 1867, Mr. Guppy notes:

"The true position of this shell is probably in the neighborhood of the family Buccinidae, in which I have provisionally placed it. Its nearest relation known to me is *Cyllene pulchella* Adams."

In 1876, Guppy again referred to *Crepidacella cepula*, placing *Dolophanes melanoides* Gabb in the synonymy.

²⁶ The name *capula* was no doubt a typographical error, as in all subsequent references Mr. Guppy called the species *cepula* (a diminutive of *cepa*). The synonymy was worked out by Mr. C. W. Johnson.

In 1873, Gabb described *Dolophanes melanoides* as a new genus and species, with the following note on its systematic position:

"The first impression produced on looking at this little shell is that it is probably a *Melania*; but apart from all of its three hundred associates being marine, which would render such a reference improbable, it has a grouping of characters which ally it so closely to *Struthiolaria*, that I am convinced that it is most probably a near related genus. Its spire is very like that of many species of *Strombidae*, and in the details of its mouth it differs from *Struthiolaria* in having a thinly encrusted inner lip, an acute outer lip and an obsolete umbilicus, instead of the thickened margins and no umbilicus of that genus. I have tried to identify this species with the shell described by Guppy as *Melanopsis capula* which it seems to resemble somewhat in form and size. But that author gives his shell but seven whorls, and does not describe or figure the flattened tops of the volutions, which are a marked character of the present species. There are also other differences which, however, might be explained by want of care in the artist, but which nevertheless, lead me to believe that, while there may be a generic relation between the two shells, they are most probably different species."

In 1881 Dr. W. H. Dall followed the description of *Pleurotoma (Mangilia) columbella* with the following remarks:

"This is a species, which in the absence of the soft parts, is difficult to locate. It is possible it should be referred to *Bela*. It is not unlike one or two Arctic species."

In the "Blake" Report, 1889, Dr. Dall refers *P. columbella*, with doubt, to *Dolophanes melanoides* as a variety; also placing *Melanopsis capula* in the synonymy, with a query. He further notes:

"Two specimens of this form are in the collection. Guppy's specimen, from the figure, was evidently deformed. These differ from it, due allowances being made for deformity, in being narrower and in the narrow shoulder in front of the suture.

"The specimen originally serving as type of *M. columbella* is the roundest and the groove behind the siphonal fasciole is reduced to a mere chink. In the Havana specimen the chink is considerably larger and the shoulder more prominent. It seems to stand about one-third of the way from *D. columbella* to *D. gabbi*. I cannot be sure, with so little material, but I suspect this gap might be filled up by a graduated series of specimens if we had material enough. Still, as the forms are not yet connected, and have already been named, it seems best to leave them separate for the present."

Dr. Dall further writes, under the description of *Dolophanes (melanoides* var.?) *gabbi*, ("Blake" Report, p. 270):

"This genus was referred to the *Struthiolariidae* by its author, a reference which has been questioned by all those who have had

occasion to refer to it since. The occurrence of a specimen in the "Blake" dredgings, which, if not identical with Gabb's type is evidently closely related to it, enables me to state that its proper position is probably in this family [Trichotropidae]. Unhappily, the operculum and soft parts are wanting so that I cannot confirm my opinion by reference to the details of its organization. I am inclined to believe that another form, also represented in the "Blake" dredgings, is a representative of a shell described as a *Melanopsis* by Guppy, which Gabb himself suspects to be closely related to his *Dolophanes melanioides*. All these specimens are fresh, but the slight traces of epidermis, which they retain, are not of the character of the northern species of *Trichotropis*. Their variations are such that I am led to believe all three may be merely mutations of one specific form. If this be confirmed, the specific name of *capula*, given by Guppy, is the oldest. Whether the differences are sufficient to constitute for *Dolophanes* a rank higher than that of a mere section of the genus *Trichotropis*, a more thorough knowledge of its characters is needed to determine. This pretty and peculiar form is named in honor of the late Wm. Gabb, to whom the generic name is due. I cannot be certain without a comparison of specimens whether the present shell is the same as that described by Prof. Gabb, or not. But the figure is so much like our shell that I can hardly doubt they are very closely related if not the same."

After a careful comparison with the groups mentioned above and others, we are convinced that *Crepidacella* belongs to the Rissoidae. According to the principles of the arrangement in Tryon's Manual of Conchology, Vol. IX, it would be a subgenus of the genus *Rissoina*, close to the Section *Mörchiella* Nevill; but the absence of a labral varix may make it expedient to treat the group as generic, though close to *Rissoina*.

As to the specific synonymy, we are satisfied that the form of the Bowden bed, Jamaica, and that of Santo Domingo named *D. melanioides* by Gabb, are specifically identical, though there are some differences, the Jamaican form being of a somewhat stouter, more robust shape. The type of *D. melanioides* measures, alt. 13.7, diam. 7 mm., length of aperture 6.8 mm. (Plate XXXIV, fig. 12). From the descriptions and figures it does not appear likely that any of the other forms included in the list given above is specifically distinct.

The type of *D. melanioides* is no. 4077 A. N. S. P.

Rissoina (Zebina) laevigata (C. B. Ad.) Plate XXXIV, figs. 3, 4.

Eulima crassilabris Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 227. Not

Rissoa crassilabrum Garrett, 1857, also a *Zebina*.

Rissoa laevigata C. B. Ad., Contrib. to Conch, 1850, p. 114.

Rissoina laevigata C. B. Ad., Tryon, Man. Conch., viii, p. 390. Dall, Tr. Wagner Free Inst. Sci., iii, p. 342.

Iopsis fusiformis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 228; Proc. A. N. S. Phila. 1872, p. 272. (Feb., 1873).

The shell is smooth except for faint growth-lines, the first two whorls somewhat convex, the rest flat. The outer lip has a low external thickening, and no denticles within.

Length 3.85, diam 1.75 mm.; $8\frac{1}{2}$ whorls (Type).

Length 3.35 mm.

These notes and the figures of Gabb's type and a smaller paratype are given to show the exact form he had. The type is slightly larger than Adams indicates for his *laevigata*, the other shell about the same size. They agree well with recent specimens so named.

The type of *E. crassilabris* and another specimen are no. 2606 A. N. S. P.

Iopsis fusiformis Gabb (Text-fig. 19) is the neanic stage of this species. There are two specimens in the type lot. The larger one, text fig. 19, measures 2.2 mm. long, 1.2 diam., having 7 whorls. The outer and basal lip is somewhat broken. The other specimen measures 1.65 by 0.85 mm., with 6 whorls. The outer lip is protractive, thin, and the base has a distinct if short and shallow spout.



Fig. 19.
Iopsis fusiformis.

These cotypes are no. 2621 A. N. S. P.

Rissoina minuta (Gabb) Plate XXXIV, fig. 1.

Cerithidea minuta Gabb Tr. Am. Philos. Soc., xv, 1873, p. 239.

The sculpture consists of many slightly protractive and weakly sinuous axial riblets, which became very weak at and below the periphery. There are very feeble and fine spiral striae above, becoming much stronger at the periphery and below it, where they are blunt, cord-like, and run over the less prominent ribs. Two of the spiral cords are visible on the penult whorl. There is a strong varix outside the sinuous lip. The aperture has a narrow channel above, and a broad, shallow sinus below. The columellar margin is worn away in the middle, as though by a hermit crab. Apical whorls wanting.

Length 4.7, diam. 2.3 mm.

Type is no. 2818 A. N. S. P.

This species is a little stouter than recent specimens labelled *R. multicostata* (C. B. Ad.). Except for the difference in the spiral sculpture, it agrees rather well with Schwartz von Mohrenstern's figure of *R. multicostata* (which represents *R. krebsi* Mörch, accord-

ing to Tryon). As the exact identity of Adams's species appears to be in doubt, and the correspondence with Gabb's shell is not absolutely exact, we leave open the question of possible identity with a recent species.

Rissoina bryerea (Mont.), variety? Plate XXXIV, fig. 2.

Bittium costatum Gabb, Tr. Am. Philos. Soc. xv, 1873, p. 239.

The type of *B. costatum* is an immature shell, lacking a half whorl perhaps, 3.65 mm. long. It agrees with *R. bryerea* (Mont.) except that there are more ribs, which are therefore somewhat smaller, but not so small as in *R. minuta* (Gabb), or *R. multcostata* (C. B. Ad.) The name used by Gabb had already been given to another species by C. B. Adams. If distinct from *bryerea* it may be called var. *binominis*.

The type is no. 2819 A. N. S. P.

Rissoa epulata Pils. and Johns. Plate XXXIV, fig. 5.

Proc. A. N. S. Phila., 1917, p. 172.

Rissoa (Alvania) proavita Pils. and Johns. Plate XXXIV, fig. 6.

Proc. A. N. S. Phila., 1917, p. 173.

CAPULIDAE.

Capulus inornatus Gabb. Plate XXX, figs. 11, 12.

Capulus inornatus Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 242.

The embryonic shell has $1\frac{1}{2}$ whorls, the spire in a plane. It is very close to the columellar margin of the last whorl. The last whorl shows faint, fine and close radial sculpture in some places. The columellar margin is coarsely crenulated, probably due to the supporting object.

Length, from umbo to opposite margin 14, width 13, convexity 7 mm.

The holotype is no. 2829 A. N. S. P.

HIPPONICIDAE.

Hipponix pilosa Desh.

Scurria mitra Esch., Gabb, Tr. Am. Philos. Soc., xv, p. 245.

Two somewhat worn examples agree well with this common West Coast species of the recent fauna. We can find no significant differences except those of time and space.

Hipponyx otiosa Pils. and Johns. Plate XXX, figs. 19, 20.

Proc. A. N. S. Phila., 1917, p. 173.

CALYPTRAEIDAE.

Crepidula plana Say.

Crypta fornicata Linn., Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 242.

There can be no doubt of the identity of the single specimen.

Crucibulum auricula (Gmel.)

Crucibulum spinosum Sby., in part, Gabb, Tr. Am. Philos. Soc., xv, p. 241.

Crucibulum auricula Gmel., Dall, Tr. Wagn. Free Inst. Sci., iii, p. 349.

A large specimen, length 25, alt. 11.7 mm., is seated on the spire of a *Conus*. Another 26 mm. long became smooth after attaining a length of 9 mm.

Crucibulum auricula spinosum Sowerby.

Crucibulum spinosum Sby., in part, Gabb, *l. c.*

Two rather small examples.

Crucibulum striatum (Say)

A single small specimen, 5.4 mm. long, is identified with some doubt. The cup is more angular anteriorly than in recent shells. Exterior smooth.

Calyptraea centralis (Conrad)

Trochita sp. undet., Gabb, Tr. Am. Philos. Soc., xv, p. 242.

The single small specimen agrees with recent shells from St. Thomas, identified as *C. candeana* Orb., a name which Dall considers a synonym of *centralis* (Trans. Wagn. Inst., iii, 353).

XENOPHORIDAE.

Xenophora dilecta (Guppy) Plate XXXII, figs. 7, 8.

Phorus agglutinans Lam., Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 241.

Phorus dilectus Guppy, Q. J. Geol. Soc., xxxii, 1876, p. 529, pl. 28, fig. 10.

This form was described and figured by Mr. Guppy from a young specimen. The shell is far less profusely loaded with shells and other objects than the recent *X. conchyliophora*, and shows a much greater part of the proper surface, which is copiously sculptured with fine protractive wrinkles. Base as in *X. conchyliophora* except that the umbilical chink is larger. The parietal wall is honey yellow. Largest example has a diameter of 68 mm.

This *Xenophora* may perhaps be a local race of *X. conchyliophora*, but its characters indicate at least subspecific distinction.

Xenophora imperforata (Gabb) Plate XXXI, figs. 3, 4.

Onustus imperforatus Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 241.

The upper surface has the usual sculpture of fine, crowded, protractive wrinkles, which are not granulous. The last $3\frac{1}{2}$ whorls

show no trace of attached objects, but several preceding whorls have little pits or facets where bits of shell or pebbles were no doubt attached, as in the recent *X. indica* (Gm.), though the agglutinating stage was shorter, not lasting beyond the size of about 8 mm. diameter. The base is nearly smooth, having growth-lines only. The narrow umbilicus is more than half covered by the dilated columellar lip. There is no spiral welt near the periphery, as in the recent *X. caribaea* (Petit), which also has a wider umbilicus and carries more load.

Alt. 30, diam. 72 mm.

Type is no. 3221 A. N. S. P.

NATICIDAE.

Natica sulcata (Born)

Natica sulcata Born, Gabb, Tr. Am. Philos. Soc., xv, p. 223.

Nearly all of the numerous examples lack the spirals of typical *N. sulcata*, being the form called *rugosa* (Gmel.).

Natica canrena (L.)

Natica canrena Linn., Gabb, Tr. Amer. Philos. Soc., xv, p. 223.

The specimens agree fully with recent shells, but they are without opercula.

Natica youngi Maury (*finitima* Pils. and Johns. Plate XXXIV, fig. 21).

Proc. A. N. S. Phila., 1917, p. 173.

This appears to be identical with the prior *N. youngi* Maury.

Polinices mamillaris (Lam.)

Mamilla mamillaris Lam., Gabb, Tr. Amer. Philos. Soc., xv, p. 223.

Natica subclausa Sowerby, Q. Journ. Geol. Soc., vi, p. 51.

This species was taken in abundance.

Amauropsis guppyi (Gabb) Plate XXXIV, figs. 25, 26, 27.

Amaura guppyi Gabb, Tr. Amer. Philos. Soc., xv, 1873, p. 224.

? *Natica phasianelloides* D'Orb., Guppy, Q. J. Geol. Soc., xxii, 1866, p. 291, pl. 17, fig. 1.

This graceful shell varies in length of the spire, as the figures show. The type measures, length 32.3, diam. 21.5 mm., and has 8 whorls, the apex not quite perfect, having lost one whorl perhaps. Others are larger, 37.4 mm. long, with $5\frac{1}{2}$ whorls remaining.

The type and numerous other specimens are no. 2881 A. N. S. P.

Amauropsis ocalana Dall²⁷ has been reported from the Rio Anima,

²⁷ Proc. U. S. Nat. Mus., ii, 1916, p. 519, pl. 88, fig. 11.

Santo Domingo.²⁸ It resembles *P. guppyi*, and the Santo Domingan specimens should be compared with that species. The specimens reported from the Canal Zone as *Lupia perovata* Conr. also need comparison with *A. guppyi*. Mr. Guppy appears to have identified this species with *Natica phasianelloides* Orb.,²⁹ but that is a very large species, 70 mm. long, and otherwise different in shape.

This species and the next have not the channelled suture of *Amauropsis*, and perhaps belong to *Ampullina* or *Lupia*.

***Amauropsis altispira* (Gabb)** Text-fig. 20.

Eutropia altispira Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 242.



Fig. 20.
Amauropsis
altispira.

The shell is imperforate, polished, composed of $5\frac{1}{2}$ rounded whorls, which slope below the suture. The columella is slightly thickened, and is dilated slightly above the axial region. Outer lip is broken.

Length 4.4, diam. 2.75 mm.

In our opinion, this is not a *Phasianella* (*Eutropia*). It appears to be a rather narrow species of *Amauropsis*. The specimen is probably not adult, but it is not the young of *A. guppyi* or of any other known species of these beds.

Type no. 2877 A. N. S. P.

***Amauropsis burnsii meridionalis* n. subsp.** Plate XXXIV, figs. 23, 24.

Close to *Polynices* (*Amauropsis*) *burnsii* Dall, of the Chipola bed, but differing by the shallower, flat-bottomed channel along the suture, the parapet bounding it being narrower. The aperture is not so wide as in *burnsii*. Lip very narrowly reflected.

Length 23.4, diam. 18 mm.; 5 whorls remaining.

Type No. 2876 A. N. S. P.

Sinum excentricum (Guppy)³⁰ is not represented in the Gabb collection.

EPITONIIDAE.

The fragmentary specimens which Gabb referred to *Scalaria*

²⁸ Ibid., xix, p. 329.

²⁹ Paléontologie of de la Sagra's Cuba; p. 9, pl. 1, fig. 7. It was found near Havana. Some doubt has been expressed by Doctor Dall as to whether the *Paléontologie* was ever properly published, but I have seen two copies of both text and plates. The text (French edition) bears date of 1853 on the title page, and as d'Orbigny dates the new species 1852, it is likely that the plates were published in that year, or perhaps that was the date of the Spanish edition.

³⁰ *Sigaretus excentricus* Guppy, Q. J. Geol. Soc., xxxii, 1876, p. 519, pl. 29, fig. 11

denticulata Sowerby do not seem sufficient for a positive determination.

Epitonium amplum (Gabb) Plate XXXIV, fig. 22.

Scalaria ampla Gabb, Tr. Am. Philos. Soc., xv, 1873, p. 224

On the last whorl the ribs become wider downwards, until near the axis they run together. In the intervals two or three low spiral cords may be seen above the much stronger basal cord. There are 10 ribs on the last whorl.

Length 14, diam. 10.8 mm., 4 whorls remaining.

Type is no. 2823 A. N. S. P. It is from the brown shale east of Guayubin.

Sthenorytis toroensis Dall, from Limon Bay, has much in common with this species, but the varices are recurved, and there is no basal cord.

Epitonium minutissimum (Gabb) Plate XXXIV, figs. 10, 11,

Scalaria minutissima Gabb, Tr. Amer. Philos. Soc., XV, 1873, p. 224.

Two of the twelve ribs on the last whorl are distinctly larger, both higher and thicker. All bear short points near the suture. In the intervals of the major spirals there are several, usually three, smaller spirals, and the whole is delicately latticed by axial threads.

Length 6, diam. 2.3 mm., $8\frac{1}{2}$ whorls remaining.

Type and 4 other specimens are no. 2824 A. N. S. P.

Epitonium santodominganum n. sp. Plate XXXIV, figs. 8, 9.

The shell is imperforate, slender, with about $3\frac{1}{2}$ smooth embryonic and $5\frac{1}{2}$ sculptured whorls. Sculpture of thin ribs on the spire, somewhat thicker on the last whorl, where there are two varices, one near its beginning, the other on the back. There are about 18 ribs in all on the last whorl. The intervals have sculpture of narrow low spiral cords, with several smaller, less distinct threads between them on the last two whorls. The cords slightly crenulate the posterior edges of the ribs. Aperture short-ovate.

Length 3.9, diam. 1.5 mm.

Type no. 4064 A. N. S. P.; with *Scalaria minutissima* Gabb.

Epitonium amosbrowni n. sp. Plate XXXIV, fig. 7.

A minute, imperforate, rather thin species, with about 2 smooth, convex embryonic whorls followed by $4\frac{1}{2}$ very convex whorls with deep suture. Sculpture of thin, equal ribs each rising in a blunt point at the shoulder, 16 on the last whorl. The intervals have low indistinct spiral cords on the lower half of each whorl, but not ex-

tending to the axis on the last whorl. Aperture very shortly oval. Length 3.3, diam. 1.5 mm.

Type and two young specimens No.4063 A.N.S.P.; with *Scalaria minutissima* Gabb and the preceding species.

Aclis (*Amblyspira*) **bartschiana** Pils. and Johns. Plate XXXV, fig. 5.

Proc. A. N. S. Phila., 1917, p. 174.

Aclis (*Hebetaclis*) **alta** (Gabb) Plate XXVII, fig. 6.

Auriculina alta Gabb, Trans. Amer. Philos. Soc., XV, 1873, p. 226.

The surface of this shell is not plain, as stated by Gabb: It is densely covered with slightly waved spiral striae, several of those below the suture being larger. The apex is obtuse, the first whorl being naticoid, glossy and smooth, with nearly level top and the tip a little turned down; subsequent whorls are convex, separated by a narrow, very deeply impressed suture. The thin concave columella passes continuously into the parietal wall.

Length 3.3, diam. 1.1 mm., $5\frac{1}{2}$ whorls.

The type, no. 3170, is the largest of five specimens.

The generic position of this graceful and delicate shell is not clear to me, but it has some resemblance to *Aclis*. The obtuse summit and the small number of relatively long whorls have caused its segregation as the type of a new subgenus to be called *Hebetaclis*. The aperture recalls that of *Berthais* Melvill, but the apical whorls differ.

PYRAMIDELLIDAE.

Doctor Bartsch's table of classification³¹ has proved indispensable in dealing with this group. Unfortunately he has not yet treated of the Antillean species.

The Santo Domingan Turbonillas all conform pretty closely to modern types, but part of the Odostomias do not fit readily into the tables arranged for recent species. This may be due to our fragmentary knowledge of the recent Caribbean Odostomias.

In addition to the species enumerated below, there are some Turbonillas and Odostomias still to be worked out.

Several species of *Turbonilla* and *Odostomia* have been described by Miss Maury, Bull. Amer. Pal. V, pp. 147-151, but the figures are so poor that no satisfactory comparisons with our species can be made from them.

³¹ A Monograph of West American Pyramidellidae, Bull. 68 U.S.N. Mus., 1909.

Pyramidella (Longchæus) jamaicensis Dall.

Pyramidella (Longchæus) jamaicensis Dall, Proc. U. S. Nat. Mus. xix, p. 315, pl. 29, fig. 10.

Callolongchæus jamaicensis Dall, Trans. Wagn. Inst. iii, p. 1584.

A single young example, length 2.3 mm., was found in the bottle with *P. canaliculata*.

Pyramidella (Triptychus) nivea (Mörch)

Obeliscus niveus Mörch, Malak. Blätter, xxii, 1875, p. 159.

Cerithium biserialatum Gabb, Journ. A. N. S. Phila. (N. Ser.), viii, p. 361, pl. 46, fig. 50.

A single young specimen agrees with Gabb's type of *C. biserialatum*, which came from Costa Rica; also with the young of the recent form. *Oscilla indiscreta* Guppy is a closely related Bowden species.

Pyramidella canaliculata (Gabb) Plate XXXV, fig. 14.

Obeliscus canaliculatus Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 225.

The shell is straightly conic. The sutural channel is formed by the excavation of the lower border of each whorl and a narrower excavation of the upper border, which is minutely crenulated just below the suture, and when quite perfectly preserved, at the shoulder angle also, at least on some of the whorls. A little thread just above the suture divides the sutural channel. There is a not very large gutter immediately below the periphery. The whorls are quite flat and plain between the channels. There are three columellar plaits, the upper one wide and subhorizontal. Within the outer lip are four plicae, the lower one small, the upper very small. Umbilicus narrow, circular, bounded by a strong, convex fasciole.

The largest entire specimen (type) is 9.5 mm. long, 3.5 wide, with 12 whorls, the tip of the spire lost. Another shell was larger, diam. 4.6 mm., the spire and last whorl broken, three strong teeth within the outer lip.

Type no. 4080 A. N. S. P.

Gabb's description and his vial of specimens were composite. The latter contained in addition to the form we select as typical *P. canaliculata*, specimens of the following species: one *Pyramidella jamaicensis*, and several *Odostomia pyrgulopsis*, which were doubtless put in as young *P. canaliculata*.

Gabb's measurements were evidently estimated from what the largest examples would measure if the lip and spire were perfect. We select an immature shell as type, since it accords best with most of his definition.

There is a *Pyramidella canaliculata* of Sowerby (Proc. Zool. Soc.,

London, 1873, p. 720). I am informed by F. Martin Duncan, Librarian of the Zoological Society, that the number of the Proceedings containing this page was published about March, 1874. It was therefore later than Gabb's species. Sowerby's *P. canaliculata* may be called *Pyramidella insularum*.

Pyramidella forulata famelica Pils. and Johns. Plate XXXV, fig. 13.

Proc. A. N. S. Phila., 1917, p. 174.

Type no. 4079 A. N. S. P. This is probably *P. olssoni* Maury.

Turbonilla (Careliopsis) turritelloides Gabb. Plate XXXVI, fig. 1.

Turbonilla turritelloides Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 226.

The nucleus is helicoid, spire rather low, of about $2\frac{1}{2}$ whorls, early post-nuclear whorls convex, becoming flattened in the lower two-thirds. There are faint traces of vertical ribs and numerous, unequal spiral striations.

Length 6.5, diam. 1.2 mm.; 14 post-nuclear whorls.

Type no. 3029 A. N. S. P. Numerous other specimens.

Turbonilla (Pyrgiscus) dominicensis Gabb. Plate XXXVI, fig. 3.

Turbonilla dominicensis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 225.

The nucleus is small, helicoid, subsequent whorls sculptured with strong, straight rounded ribs, which are very slightly protractive on the upper part, changing to slightly retractive in the last three whorls. On the penult whorl there are 20 ribs. On the last whorl the ribs gradually disappear just below the periphery. Spiral sculpture of weak, unequal striae, not visible on the summits of the ribs; the base is convex, with more regular spiral striae. The whorls are somewhat convex throughout. The columella is thin, slightly sinuous, the edge reflected and appressed above.

Length 6, diam. 1.4 mm., $9\frac{1}{2}$ post-nuclear whorls.

Type no. 3031 A. N. S. P.

Turbonilla (Pyrgiscus) santodomingensis Pils. and Johns. Plate XXXVI, fig. 4.

Proc. A. N. S. Phila., 1917, p. 175.

Turbonilla (Pyrgiscus) beatula Pils. and Johns. Plate XXXVI, fig. 2.

Proc. A. N. S. Phila., 1917, p. 174.

Turbonilla (Chemnitzia) galeata Pils. and Johns. Plate XXXVI, fig. 5.

Proc. A. N. S. Phila., 1917, p. 175.

Turbonilla (Chemnitzia) peræqua Pils. and Johns. Plate XXXVI, fig. 6.

Proc. A. N. S. Phila., 1917, p. 175.

Turbonilla (Nisiturris) angustula Pils. and Johns. Plate XXXVI, fig. 7.

Proc. A. N. S. Phila., 1917, p. 176.

Turbonilla (Nisiturris) aratibacillum Pils. and Johns. Plate XXXVI, fig. 8.

Proc. A. N. S. Phila., 1917, p. 176.

Turbonilla (Nisiturris) insititia Pils. and Johns. Plate XXXVI, fig. 9.

Proc. A. N. S. Phila., 1917, p. 176.

Turbonilla (Nisiturris) undecimcostata Pils. and Johns. Plate XXXVI, fig. 10.

Proc. A. N. S. Phila., 1917, p. 177.

Turbonilla (Nisiturris) pertenuis Gabb. Plate XXXVI, fig. 11.

Proc. A. N. S. Phila., 1917, p. 177.

Turbonilla (Nisiturris) contexta Pils. and Johns. Plate XXXVI, fig. 12.

Proc. A. N. S. Phila., 1917, p. 177.

It may be noted here that *Turbonilla bartschiana* and *T. gatunensis* Brn. & Pils.³² belong to the subgenus *Nisiturris*, not to *Chemnitzia* as originally stated.

Turbonilla (Tragula) egressa Pils. and Johns. Plate XXXVI, fig. 13.

Proc. A. N. S. Phila., 1917, p. 178.

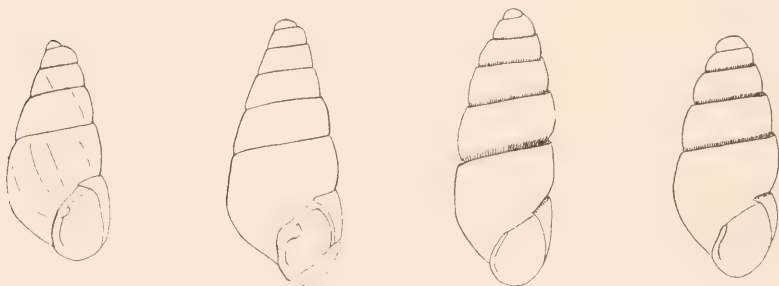


Fig. 21. *Odostomia* Fig. 22. *O. ingloria* Fig. 23. *O. santodomingensis* Fig. 24. *O. myrmecoon*.
ingloria. calvata.

Odostomia (Odostomia) ingloria Pils. and Johns. Text-fig. 21.

Proc. A. N. S. Phila., 1917, p. 178.

Odostomia santodomingensis Pils. and Johns. Text-fig. 23.

Proc. A. N. S. Phila., 1917, p. 179.

Odostomia myrmecoon Pils. and Johns. Text-fig. 24.

Proc. A. N. S. Phila., 1917, p. 179.

Odostomia (Eulimastoma) pyrgulopsis Pils. and Johns. Text-fig. 25.

Proc. A. N. S. Phila., 1917, p. 179.

³²Proc. A. N. S. Phila. 1912, pp. 509, 510.

Odostomia (Eulimastoma) bathyraphe Pils. and Johns. Text-fig. 26.

Proc. A. N. S. Phila. 1917, p. 180.



Fig. 25. *Odostomia pyrgulopsis*.



Fig. 26. *O. bathyraphe*.



Fig. 27. *O. vexator*.

Odostomia (Evalea?) vexator Pils. and Johns. Text-fig. 27.

Proc. A. N. S. Phila., 1917, p. 180.

Odostomia (Goniodostomia) superans Pils. and Johns. Text-fig. 28.

Proc. A. N. S. Phila. 1917, p. 180.

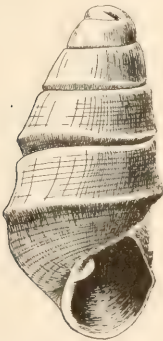


Fig. 28. *Odostomia superans*.



Fig. 29. *O. circumvincta*.

Odostomia (Goniodostomia) circumvincta Pils. and Johns. Text-fig. 29.

Proc. A. N. S. Phila., 1917, p. 181.

Odostomia (Parthenina?) cyclocephala Pils. and Johns. Plate XXXVI, fig. 14

Proc. A. N. S. Phila., 1917, p. 181.

Odostomia (Odostomidea) bartschiana Pils. and Johns. Plate XXXVI, fig. 15.

Proc. A. N. S. Phila., 1917, p. 182.

Odostomia (Odostomidea) mogindo n. sp. Plate XXXVI, fig. 16.

The shell resembles *O. bartschiana*, but has the whorls swollen and shouldered below the suture. The first whorl is smooth, strongly convex above, turned in at the apex, the suture deep from the be-

ginning. The second whorl is convex, weakly ribbed; third and later whorls are swollen and subangular below the suture, then flattened with sculpture of large, well-spaced, axial ribs, the concave intervals finely striate, with in some places the faintest traces of spiral striae also. On the last whorl there are eleven ribs, on the penult ten. On the dorsal part of the last whorl the ribs disappear towards the base. The small aperture is ovate and oblique, with continuous peristome and a strong submedian fold on the inner margin.

Length 2.35, diam. 0.83 mm.; slightly over 6 whorls.

Type no. 3016 A. N. S. P.

Odostomia (Chrysallida) dulcis Pils. and Johns. Plate XVIII, fig. 7.

Proc. A. N. S. Phila., 1917, p. 182.

MELANELLIDAE. (*Eulimidae*)

Niso grandis Gabb. Plate XXXIV, fig. 17.

Niso grandis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 227.

This shell is represented by a specimen of 4 whorls, the upper part and the last half whorl wanting. The remaining whorls are a trifle more convex and shorter than the corresponding part of *Niso willcoxiana* Dall, indicating a distinct though allied species. The length is 19.3, diam 12.4 mm.

Type no. 3018 A. N. S. P.

Niso minuta Gabb. Text-fig. 30.

Niso minuta Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 227.

A single example, no. 3019. The 6 whorls are just perceptibly convex. The last three have slender white axial lines, which appear to be very slightly raised on the pale gray ground. There is a strong keel about the umbilicus, but none at the periphery.

Length 1.85, diam. 0.95 mm.

Further specimens are needed to show whether it attains a greater size.

Melanella astuta Pils. and Johns. Plate XXXV, fig. 7.

Proc. A. N. S. Phila., 1917, p. 182.

Melanella gabbiana Pils. and Johns. Plate XXXV, fig. 6.

Proc. A. N. S. Phila., 1917, p. 183.

Strombiformis sarissiformis Pils. & Johns. Pl. XXXV, fig. 9.

Proc. A. N. S. Phila., 1917, p. 183.

The aperture is wider in the unbroken adult stage than in the

type, which has lost about one-fourth of a whorl.

Strombiformis prælubrica Pils. and Johns. Plate XXXV, fig. 10.

Proc. A. N. S. Phila., 1917, p. 183.

Strombiformis ischnon Pils. and Johns. Plate XXXV, fig. 8.

Proc. A. N. S. Phila., 1917, p. 183.



Fig. 30.
Niso minuta.

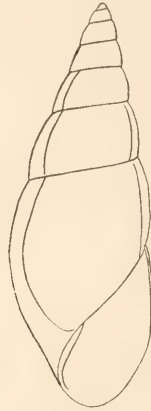


Fig. 31.
Strombiformis stimulus.

Strombiformis stimulus Pils. and Johns. Text-fig. 31.

Proc. A. N. S. Phila., 1917, p. 183.

This minute shell is not a *Subularia*, as it lacks the axial keel near the base and is not noticeably flattened dorso-ventrally.

TURBINIDAE.

Turbo dominicensis Gabb. Plate XLII, figs. 16, 17.

Turbo dominicensis Gabb, Tr. Amer. Philos. Soc., xv, 1873, p. 242.

Seven specimens are all imperfect, but the species is well characterized. There is a conspicuous, beaded spiral cord below the suture, followed by five minor beaded spirals, alternately smaller and larger; then another prominent cord followed by three minor spirals the middle one larger. At the periphery there is a third larger cord, and below it about 9 spirals, those on the base subequal, and all cut into beads by axial grooves. Around the axial region there is a broad and conspicuous callus. The shell was unusually thin for a *Turbo*. The specimen selected as type (fig. 16) consists

of little more than two whorls. Another (fig. 17) shows the conic spire usual in the genus.

Diameter of type 25 mm.

Many opercula of *Turbo* collected probably belong, at least in part, to this species. Unworn specimens vary remarkably in the degree of callous filling over the nucleus, the number of spiral furrows and the amount of granulation; the series forming a transition from the operculum of *Senectus* to that of *Callopoma*. It appears likely that several species of *Turbo* are involved.

Type no. 2843 A. N. S. P.

Astræa domingensis Pils. and Johns.

Proc. A. N. S. Phila., 1917, p. 184.

This is perhaps *Astraliu sublongispinum* Maury. It resembles *A. karlschmidtii* in shape, but has more numerous spirals above.

PHASIANELLIDAE.

Phasianella affinis C. B. Ad.

Lacuna punctata Gabb, Tr. Amer. Philos. Soc., xv. 1873, p. 240.

The umbilical groove appears slightly deeper, its bounding angle shorter than in recent specimens compared; yet the difference is so small that we have no doubt of the specific identity.

Gabb's type lot, 13 specimens are no. 2820 A. N. S. P.

Eutropia altispira Gabb is a Naticid gastropod.

NERITIDAE.

Smaragdia viridis (L.)

Nerita viridis L., Syst. Nat., x, 778.

Neritina viridis L., Gabb, Tr. Amer. Philos. Soc., xv, p. 242.

The specimens are all small, up to 3.8 mm. long, and show a trace of the green ground color, as well as the linear markings. They are more like European than recent West Indian specimens.

TROCHIDAE.

Tegula viridula (Gmel.)

Omphalius viridulus Gabb, Trans. Amer. Philos. Soc., xv, p. 243.

Calliostoma leve n.n. Text-fig. 32.

Calliostoma conica Gabb, Tr. Amer. Philos. Soc., xv, 1873, p. 243. Not *Trochus conicus* Donovan, also a *Calliostoma*.

The shell is imperforate and straightly conical. Each whorl has 6 spiral cords, separated by narrow grooves, above the peripheral cord. On the upper whorls these

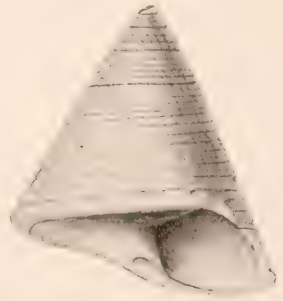


Fig. 32. *Calliostoma leve*.

cords are distinctly beaded by retractive grooves, but the beading is weaker on the last whorl. The flat base has about 12 small smooth cords.

Alt. 5, diam. 4.6 mm., 6 whorls.

Type is no. 2821 A. N. S. P. One specimen.

Solariella (?) tricarinata (Gabb) Text-fig. 33.

Margarita tricarinata Gabb, Tr. Amer. Philos. Soc., xv, p. 243.

This minute shell has three strong coarinae in the peripheral region and rounded beads below the suture and on the umbilical angle. There are some short radial folds external to the latter. The initial $1\frac{1}{2}$ whorls are smooth and rounded. It is obviously a very young shell and possibly belongs to *Liotia*.

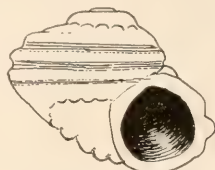


Fig. 33. *Solariella tricarinata*.

Alt. 1.15, diam. 1.4 mm.; 3 whorls.

Type is no. 2836 A. N. S. P.

CYCLOSTREMATIDAE.

Circulus pentagona (Gabb)

Vitrinella pentagona Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 243; Journ. Acad. N. S. Phila. viii, p. 368, pl. 47, fig. 68.

This species resembles *C. trilix* (Bush), but is much smaller. The unique type measures, alt. 0.9, diam. 1.9 mm.; $3\frac{3}{4}$ whorls. The front part of the last whorl is broken, but shown restored in Gabb's figure.

Type no. 2831 A. N. S. P.

Circulus domingensis Pils. and Johns. Plate XXXVII, figs. 6, 6a, 7.

Proc. A. N. S. Phila., 1917, p. 184.

In a smaller, more perfect specimen found among Gabb's duplicates, there are more numerous, smaller spirals within the umbilicus (Plate XXXVII, fig. 7). In the type the ribs are worn on the periphery, hence appear weaker in the figure than in perfect specimens.

Vitrinella (Episcynia) naso (Pils. and Johns.) Plate XXXVII, figs. 5, 5a.

Discopsis (?) naso Pils. and Johns., Proc. A. N. S. Phila. 1917, p. 184.

Adeorbis carinata Gabb is thought by Dall to be "probably identical with *Vitrinella (Episcynia) inornata* Orb." (Trans. Wagner Inst. III, 420). This note was overlooked at the time we redescribed the form in 1917. While it is apparently related to that recent species (which we know only by Orbigny's account and figures), we consider it specifically distinct.

Vitrinella (Solariorbis) amosbrowni n. sp. Plate XXXVII, figs. 4, 4a.

The shell is perforate, conic, of $4\frac{1}{2}$ rather rapidly increasing, moderately convex whorls, the earlier ones smooth, the penult showing some weak spirals above the suture, the last whorl having about five weak well-spaced spiral cords in the peripheral region, a few still weaker ones traceable above them, and about five smaller, closer spirals below them, occupying all but the central region of the base. Under the compound microscope the surface between the spirals appears densely, irregularly pitted or granose. In the middle part of the base it is finely radially striate and granose. The aperture is somewhat squarish in front view, oblique; the basal lip arches forward a little in a basal view. The peristome is thickened within, the columellar margin strongly so.

Alt. 1, diam. 1.55 mm.

Type no. 4059 A. N. S. P.

Teinostoma angulatum (Gabb) Plate XXXVII, figs. 1, 1a, 1b.

Cyclops angulatus Gabb, Tr. Amer. Philos. Soc., xv, 1873, p. 214,

The last whorl does not cover the spire completely, as a segment of the suture is exposed, and the rest is visible through the transparent last whorl. There seem to be about $2\frac{1}{2}$ whorls. In the last whorl the suture leaves its former course at a right angle and describes a semicircle to the periphery. The last whorl is angular peripherally in front, but becomes rounded at the end. The dome-like upper surface is covered with very fine spiral striae. The axial callus is large, and formed as in *Umbonium* or *Helicina*.

Alt 1.7, diam. 3.7 mm.

Type no. 2837 A. N. S. P.

This species and the next belong to a section of *Teinostoma* which may be called *Idioraphe*, type *T. angulatum*, characterized by having the whorls enveloping, the suture at first closely coiled, but in the last whorl deviating abruptly. *T. cryptospira* Verrill is an allied recent species. *T. sandomingensis*, which we have not seen, is probably near *T. angulatum*.

Teinostoma depressum (Gabb) Plate XXXVII, figs. 2, 2a, 2b.

Cyclops depressa Gabb, Tr. Amer. Philos. Soc., xv, p. 214.

In this tiny species the tip of the spire is exposed, the periphery is rounded, and there are no spiral striae.

Alt. 0.65, diam. 1.3 mm.

The single example no. 2830 A. N. S. P., is probably not adult.

We think that the suture might become curved or tangential with further growth.

Teinostoma vitreum (Gabb) Plate XXXVII, figs. 3, 3a, 3b.

Umbonium vitreum Gabb, Tr. Amer. Philos. Soc., xv, 1873, p. 243.

Parkeria vitrea Gabb, Journ. Acad. Nat. Sci. Phila. viii, p. 368, pl. 47, fig. 69.

This is an *Umbonium*-like shell of $3\frac{3}{4}$ whorls. Faint, close spiral striae may be seen on the upper part of the last whorl under strong magnification. The basal callus is like that of *Helicina*, its outer edge rather indistinct. There is a thick parietal callus somewhat exaggerated in Gabb's figure.

Alt. 1.1, diam. 1.85 mm.

Type no. 2833 A. N. S. P.

This species belongs to the subgenus *Pseudorotella*. It is type of *Parkeria* Gabb, not *Parkeria* Carpenter & Brady, 1869 (Protozoa).

FISSURELLIDAE.

Diadora alternata henekeni Maury.

Lucapina alternata Say, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 244.

Fissuridea henekeni Maury, Bull. Amer. Pal. V, p. 157.

The four specimens, no. 3163, differ somewhat from recent *F. alternata*; the concentric cords are closer, rising into higher scales on the radial ribs, and the orifice is relatively a little longer, one-sixth the total length.

SCAPHOPODA.

As the Scaphopoda have been already described and illustrated in a special paper, it is not necessary to repeat the matter here.

Dentalium rudis Gabb, Trans. Amer. Philos. Soc., xv, p. 244, appears to be a worm tube. It has been figured in Proc. A. N. S. Phila., 1897, p. 471, pl. 10, figs. 4, 8.

DENTALIIDAE.

Dentalium cossmannianum Pilsbry and Sharp.

Dentalium cossmannianum Pilsbry & Sharp, Proc. A. N. S. Phila. 1897, p. 467, pl. 10, fig. 11; pl. 11, figs. 10, 11.

Type no. 2709 A. N. S. P.

Dentalium callioglyptum Pilsbry and Sharp.

Dentalium callioglyptum P. and S., Proc. A. N. S. Phila., 1897, p. 468, pl. 10, figs. 11, 12; pl. 11, fig. 21.

Type no. 2713 A. N. S. P.

Dentalium tryoni Pilsbry and Sharp.

Dentalium tryoni P. and S., Proc. A. N. S. Phila., 1897, p. 468, pl. 10, figs. 5, 9; pl. 11, fig. 22.

Type no. 2710 A. N. S. P.

Dentalium dissimile Guppy.

Dentalium dissimile Guppy, Quart. Journ. Geol. Soc., xxii, 1866, p. 292, pl. 17, fig. 4. Pilsbry and Sharp, Proc. A. N. S. Phila., 1897, p. 469, pl. 11, figs. 3, 4, 5.

The specimens are no. 2712 A. N. S. P.

Dentalium dissimile ponderosum Gabb.

Dentalium ponderosum Gabb, Tr. Amer. Philos. Soc., xv, 1873, p. 244.

Dentalium dissimile var. *ponderosum* Gabb, Pilsbry and Sharp, Proc. A. N. S. Phila. 1897, p. 470, pl. 10, figs. 1, 2, 3; pl. 11, figs. 15, 16.

Type no. 2708 A. N. S. P.

Dentalium gabbi Pilsbry and Sharp.

Dentalium affine Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 244. Not of Deshayes.

Dentalium gabbi P. and S., Proc. A. N. S. Phila., 1897, p. 470, pl. 10, figs. 6, 7, 13; pl. 11, figs. 1, 2.

Type no. 2711 A. N. S. P.

Dentalium haytense Gabb.

Dentalium haytensis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 244.

Dentalium haytense Gabb, P. and S., Proc. A. N. S. Phila., 1897, p. 471, pl. 11, figs. 8, 9.

Type no. 2715 A. N. S. P.

Dentalium pyrum Pilsbry and Sharp.

Dentalium pyrum P. and S., Proc. A. N. S. Phila., 1873, p. 472, pl. 11, figs. 6, 7.

Type no. 2714 A. N. S. P.

Dentalium praecursor Pilsbry and Sharp.

Dentalium praecursor P. and S., Proc. A. N. S. Phila. 1873, p. 472, pl. 11, figs. 12, 13, 14.

Type no. 2717 A. N. S. P.

Dentalium sagittarii Pils. and Johns. Plate XVIII, fig. 12.

Proc. A. N. S. Phila., 1917, p. 185.

Dentalium eboreum Conrad (?)

A series of small, very slender Graptacmes, probably none of them mature, is referred provisionally to this recent species.

No. 2882 A. N. S. P.

SIPHONODONTALIIDAE

Cadulus phenax Pilsbry and Sharp.

Gadus dominguensis d'Orb., Gabb, Tr. Amer. Philos. Soc., xv, p. 472.

Cadulus phenax Pils. and Sharp, Proc. A. N. S. Phila., 1897, p. 472, pl. 11, figs. 23, 24.

Type no. 2883 A. N. S. P.

Cadulus elegantissimus Pilsbry and Sharp.

Cadulus elegantissimus P. and S., Proc. A. N. S. Phila., 1897, p. 473, pl. 11, figs. 28, 29, 30.

Type no. 2885 A. N. S. P.

Cadulus depressicollis Pilsbry and Sharp.

Cadulus depressicollis P. and S., Proc. A. N. S. Phila., 1897, p. 473, pl. 11, figs. 25, 26, 27.

Type no. 2884 A. N. S. P.

Cadulus colobus Pilsbry and Sharp.

Cadulus colobus P. and S., Proc. A. N. S. Phila., 1897, p. 474, pl. 11, figs. 17-20.

Type no. 2886 A. N. S. P.

PELECYPODA.

NUCULIDAE.

Nucula (Acila) tuberculata Gabb. Plate XXXVIII, fig. 5.

Nucula (Acila) tuberculata Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 255.

The right valve is a trifle larger and its lunule is smaller, that of the left valve being large. The narrow escutcheon is smooth. Posterior dorsal slopes are obliquely corrugated, the rest of the valve tuberculate in the middle and upward, the tubercles obsolete in the lower third, which has sculpture of growth striae and fine, not prominent, radial threads. There are 8 anterior teeth, 16 posterior, in a specimen 6.5 mm. long.

Length 7, alt. 6.2, diam. 4 mm.

Type and numerous separate valves are no. 2658 A. N. S. P.

Nucula tenuisculpta Gabb. Plate, XXXVIII, fig. 6.

Nucula tenuisculpta Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 255.

?*Nucula crenulata* A. Ad., Dall, "Blake" Pelecypoda, Bull. M. C. Z. xii, no. 6, p. 247; Trans. Wagn. Inst., iii, p. 577.

Dall has identified Gabb's species with the recent *N. crenulata*, which appears to be typically much more coarsely sculptured. As the numerous specimens from Santo Domingo are very uniform in sculpture it seems possible that they form a recognizable race or perhaps a species.

N. tenuisculpta is finely wrinkled concentrically, and radially closely striate, the striae appearing as gray lines, which so far as we can tell are little if at all impressed. Internal border finely crenulated. The largest of numerous valves measures, length 3.35, alt. 2.8 mm.

Gabb's type is no. 2656 A. N. S. P.

Specimens of this species were found in the mud washed out of *Cymatium praefemorale*, no. 3222.

LEDIDAE.

Leda extricata Pils. and Johns. Plate XXXVIII, figs. 1, 1a.

Proc. A. N. S. Phila., 1917, p. 185.

Yoldia ovalis Gabb. Text-fig. 34.

Yoldia ovalis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 255.

Externally there are some low concentric wrinkles in the lower half of the otherwise smooth valve. Length 8.2, alt. 4.5, diam. of one valve 1.5 mm.

Type no. 3319, a single left valve.

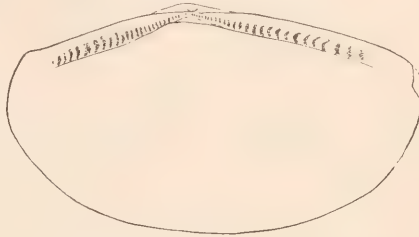


Fig. 34. *Yoldia ovalis* Gabb, Type.

LIMOPSIDAE.

Limopsis ovalis Gabb. Text-fig. 35.

Limopsis ovalis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 255.

The sculpture consists of many fine thread-like radii and much

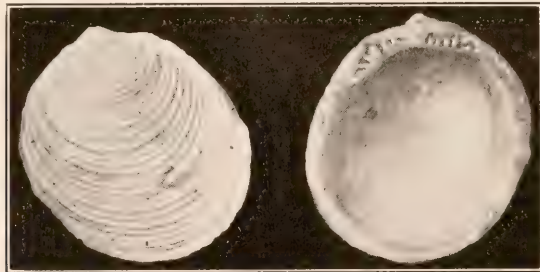


Fig. 35. *Limopsis ovalis* Gabb.

more prominent and coarser, unequal concentric wrinkles. The hinge has 8 teeth on each side of the median hiatus.

Length 9, alt. 9.7, semidiam. 2.5 mm. (Type).

Type is no. 2657 A. N. S. P.

Two smaller valves are nearly circular in outline. It becomes oval with age, as Gabb remarked.

ARCIDAE.

Arca umbonata Lamarck.

Arca imbricata Brug., Gabb, Trans. Amer. Philos. Soc., xv, p. 254.

Arca umbonata Lamarck, Dall, Trans. Wagn. Inst., iii, p. 620.

Characteristic specimens of this well known species are contained in no. 2647.

Arca bonaczyi (Gabb) Plate XXXIX, figs. 1, 2.

Barbatia bonaczyi Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 254.

This species stands very close to *A. candida* Gmel., and a fuller series may show that it is not separable. It differs by the narrower form and very slight byssal sinuosity, which indeed is not visible in the type valve, though noticeable in a smaller one.

Length 34, alt. 18, diam. of right valve 7 mm.

Type no. 2649 A. N. S. P.

Arca inæquilateralis Guppy.

Arca inæquilateralis Guppy, Q. J. Geol. Soc., xxii, 1866, p. 293, pl. 18, figs. 2a, b.

Two specimens. It appears to be more abundant in the Bowden bed.

Arca (Scapharca) pennelli Gabb. Plate XXXIX, figs. 3, 4.

A. (Anadara) pennelli Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 254.

The type, a left valve, has 36 ribs. They are closely granose except at the ends, where granulation is obsolete. The intervals have sharp, irregular transverse striae. The cardinal area is narrow, marked with a few waved longitudinal grooves, and defined by a narrow strong keel. The hinge has a continuous tooth row of 16 and 35 teeth, irregular where the series meet.

Length 36, alt. 27, diam. of left valve 13 mm.

Type is no. 2651 A. N. S. P.

In the right valve of another specimen the ribs are smooth.

Arca (Scapharca) sobrina Pils. and Johns.

Proc. A. N. S. Phila. 1917, p. 186

= *Arca henekeni* Maury.

Arca (Scapharca) copiosa Pils. and Johns.

Proc. A. N. S. Phila. 1917, p. 186.

= *A. margaretæ* Maury.

Arca (Scapharca) devexa Pils and Johns. Plate XLI, figs. 8, 9.

Proc. A. N. S. Phila. 1917, p. 187.

Arca (Scapharca) intumulata Pils. and Johns. Plate XXXIX, figs. 7, 8, 9.

Proc. A. N. S. Phila. 1917, p. 187.

Arca (Scapharca) proletaria Pils. and Johns. Plate XXXIX, figs. 5, 6.

Proc. A. N. S. Phila. 1917, p. 188.

Arca grandis Broderip and Sowerby. Plate XL, fig. 1.

Arca grandis B. and S., Zool. Journ. iv, 1829, p. 365. Reeve, Conch. Icon. ii, pl. 1, fig. 4. Kobelt, Syst. Conch. Cab. p. 41, pl. 12, fig. 1. Carpenter, Rep. B. A. A. S., for 1856, pp. 1, 249, pl. 6, figs. 1-4.

Arca (Anadara) grandis Brod. and Sby., Gabb, Trans. Amer. Philos. Soc., xv, p. 253, in part.

Arca patricia Maury. Bull. Amer. Pal. v, pl. 27.

There are twelve large valves of this species in the Gabb collection from Santo Domingo (no. 2720, 2721), two from 20 miles west of Azua, Haiti, collected by Mr. Lloyd B. Smith (no. 2662), and nine from near Cartagena, Colombia (no. 2661), also taken by Mr. Smith. We formerly thought that the fossils of the Caribbean area were separable from *A. grandis* of the recent Panamic Province, but a close study of all the material shows that no separation can be made.³³

While somewhat related to *A. chiriquiensis* Gabb, this species differs in shape and by the smaller number of ribs, 24 to 26; *chiriquiensis* having 28 to 30. They are larger, and remain better developed on the posterior dorsal slope. The shell is nearly equi-valve, extremely large, solid and heavy. The posterior lower angle is produced, anterior end rounded, basal margin nearly straight. The beaks are extremely large, giving the shell a triangular contour, and projecting far above the hinge. Cardinal area very broad, in form of a nearly symmetrical triangle, being scarcely or not longer posteriorly than in front of the beaks; marked with grooves meeting at a wide angle (but in adults usually eroded, showing the striation derived from growth of the teeth). Sculpture of 25 strong radial ribs, the anterior ones slightly granulated (this is more obvious in the young); the granules, transverse, rather widely and unevenly spaced. Intercostal spaces show rather sharp growth-striae. The

³³Mr. Gabb reached the same conclusion; but as he included *A. chiriquiensis*, and thought *A. tolepis* the young, his decision has not influenced the opinion expressed above.

It may be noted that J. C. Moore identified *A. grandis*, with some doubt, from Mr. Heneken's second sending of Santo Domingo fossils, in Q. J. Geol. Soc., ix, 1853.

hinge is heavy, set with thin, very close, vertical teeth, the tooth-row being curved down a little at the posterior end. Basal margin very coarsely fluted within.

Length 117, alt. 106, diam. of right valve 56 mm.

Arca chiriquiensis Gabb. Plate XL, figs 2, 3, (Chiriqui), 4-6 (S. Domingo).

Arca chiriquiensis Gabb, Proc. A. N. S. Phila., 1860, p. 567, (1861).

Arca (*Scapharca*) *chiriquiensis* Gabb, Dall, Trans. Wagn. Inst., iii, p. 642.

? *Arca patricia* Sowerby, Q. J. Geol. Soc., vi, 1849, p. 52.

The figures represent a type (Plate XL, fig. 2) and paratype (Plate XL, figs. 3). Plate XLI, figs. 1-3 are other specimens from the blackish shale at Chiriqui. It is equivalve, and the valves are alike except that two or three more of the ribs are granulose in the left valve than in the right. The prominent beaks are moderately to widely separated by a broad, flat cardinal area marked with some angulate grooves. The valves convex before the middle, flattened or even very little concave behind it; about 10 posterior ribs in the left valve, 12 in the right, are nearly smooth, the rest being closely, or sometimes somewhat sparsely, granose. The ribs are weak on the posterior slope. Intervening grooves are irregularly marked with growth striae.

Length 43, alt. 43 mm.; 29 ribs.

Length 40, alt. 34, diam. 36 mm.; 30 ribs.

Length 73, alt. 70 mm.; 31 ribs (largest).

Gabb subsequently considered *A. chiriquiensis* a synonym of *A. grandis*, but it is not even closely related.

The granulation is best developed in young or half-grown examples becoming more or less obsolete in old ones. The degree of separation of the beaks also varies. The lot of about 40 examples from Chiriqui, collected by Dr. John Evans, shows but little other variation.

Santo Domingan specimens (Plate XL, figs 4, 5, 6) are less extensively granose and the beaks are less widely apart than in many of the type lot, though agreeing with others. The concavity behind the middle is slightly more marked. All of the specimens are somewhat worn.

Length 55, alt. 51, diam. of right valve 23 mm.

Length 35, alt. 33, diam. 36 mm.

Besides the above (no. 2722 Gabb Coll., numerous specimens), some fragments were obtained by Mr. W. W. Webster on a stream between Las Caobas and Hinche, Haiti.

It appears likely that this species is the lost *Arca patricia* of

Sowerby, which has also been identified with *A. grandis*. It agrees better than any other Santo Domingan species with the brief and inconclusive diagnosis of that shell. Sowerby states that his species has "rather more numerous" ribs than *A. grandis*, and that it "is much more rounded at the inferior margin", "*marginē inferiori rotundato*". As far as it goes, this applies to *A. chiriquiensis*; yet as no definite information on the type specimen is available, the name given by Gabb is preferred, since there is no doubt about its identity.

Arca chiriquiensis websteri Pilsbry. Plate XLI, fig. 4.

Arca websteri Pils., Proc. A. N. S. Phila., 1910, p. 488.

This form is more lengthened than *A. chiriquiensis* and more of the ribs are granose; yet it is probably a form of *chiriquiensis*. The type valve is figured.

Length 44, alt. 35, semidiam. 18 mm.

On a stream between Las Caobas and Hinche, Haiti, W.W. Webster.

Type no. 1312 A. N. S. P.

Arca dolaticosta Pils. and Johns. Plate XLI, figs. 5, 6.

Proc. A. N. S. Phila. 1917, p. 188.

Chiriqui.

Arca* (*Scapharca*) *coccopleura Pils. and Johns.

Proc. A. N. S. Phila. 1917, p. 188.

= *A. hispaniolana* Maury.

Arca* (*Argina*) *tolepia (Dall.).

Scapharca (*Argina*) *tolepia* Dall, Trans. Wagn. Inst., iii, p. 649, pl. 33, figs. 7, 8

This is one of the most abundant arks. By Gabb the specimens were referred to *A. grandis* as young. It is somewhat variable. From the adhering material it is evident that several beds are represented.

Three forms seem to be distinguishable, additional to the typical form. Whether these are species, or successive or synchronous mutations of *A. tolepia*, cannot be determined until their stratigraphic place is known.

A. arthurpennelli Maury appears to be based upon part of Gabb's specimens. It may be distinct from *tolepia*, described from Rio Amina.

Arca tolepia saxea Pils. and Johns. Plate XXXIX, fig. 10.

Proc. A. N. S. Phila. 1917, p. 189.

Arca tolepiea scapularis Pils. and Johns. Plate XXXIX, figs. 13, 14.

Proc. A. N. S. Phila. 1917, p. 189.

Arca tolepiea crassicardinis Pils. and Johns. Plate XXXIX, figs. 11, 12.

Proc. A. N. S. Phila. 1917, p. 189.

Arca cyclica Pils. and Johns. Plate XXXIX, figs. 15, 16.

Proc. A. N. S. Phila. 1917, p. 189.

Arca perfaceta Pils. and Johns. Plate XXXIX, figs. 17, 18, 19, 20.

Proc. A. N. S. Phila. 1917, p. 190.

Arca pomponiana Pils. and Johns. Plate XLII, figs. 4, 5, 6.

Proc. A. N. S. Phila. 1917, p. 190.

Arca multilineata Gabb. Plate XLII, figs. 13, 14.

Arca multilineata Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 254.

This small, plump shell has triangular rounded contour, the anterior end narrowly, the posterior broadly rounded. Sculpture of many radial ribs crossed by concentric threads over ribs and intervals. In the median fourth the ribs widen towards the basal border and the intervals remain simple, but over the rest of the valve interstitial riblets arise in the intervals, about midway, and many of them become as large as the primary ribs near the basal margin. The cardinal area is narrow and smooth. Tooth row continuous, with 9 and 11 teeth, those of the posterior part strongly oblique, in the anterior part slightly oblique.

Length 10, alt. 9.5, diam. of right valve 4 mm.

Type and three other right valves are no. 2652 A. N. S. P.

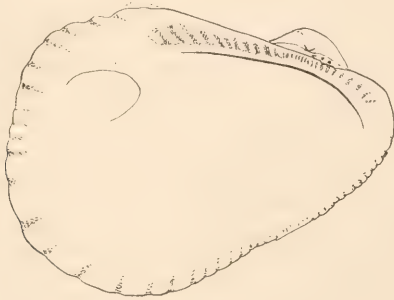


Fig. 36. *Arca maoica*.

Arca maoica Maury. Text-fig. 36.

Arca cuneolus Pils. and Johns., Proc. A. N. S. Phila. 1917, p. 191.

The figure represents the type of *A. cuneolus*, which is apparently a synonym of *A. maoica* Maury.

Arca idiodon Pils. and Johns. Plate XLII, figs. 3, 10.

Proc. A. N. S. Phila. 1917, p. 191.

Wilmington, N. C.

Glycymeris acuticostatus (Sowerby)

Pectunculus acuticostatus Sowerby, Q. J. Geol. Soc., vi, 1849, p. 53, pl. 10, fig. 13.

Axinæa acuticostata Sby., Gabb, Tr. Am. Philos. Soc. XV, p. 255.

A very abundant shell. No. 2645 A. N. S. P.

Glycymeris approximans (Gabb) Plate XLII, figs. 7, 11, 13.

Axinæa approximans Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 255.

A very thin species having about 42 rather strong, rounded ribs, crossed by delicate, equally spaced concentric threads. The hinge is remarkably narrow, but little curved, having 15 short but rather high teeth. Margin with the deeply fluted band very narrow.

Length 8.6, alt. 8.6, diam. of type valve 2.4 mm.

Type and a smaller valve are no. 2650 A. N. S. P.

There is another lot containing much larger but badly worn or broken examples. The largest has an alt. of 21 mm., hinge with about 18 teeth, the row interrupted mesially.

Glycymeris santodomingensis Pils. and Johns. Plate XLII, figs. 12, 18.

Proc. A. N. S. Phila. 1917, p. 192.

Glycymeris diffidentæ Pils. and Johns. Plate XLII, figs. 8, 9.

Proc. A. N. S. Phila. 1917, p. 192.

PINNIDAE.

Atrina sp. undet.

Pinna sp., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 253.

This species has more dorsal ribs than *A. chipolana* Dall. The fragment is scarcely sufficient for specific definition.

PTERIIDAE.

Pteria inornata (Gabb.) Plate XLII, figs. 6, 7.

Avicula inornata Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 253.

All the specimens are broken. The largest (type) measures 24.7 mm. long, as figured. It is strongly convex. There is also an interval cast no. 2641, which shows the shape much better than the shells (Plate XLII, fig. 7).

Type and numerous imperfect valves, no. 2748 A. N. S. P.

OSTREIDAE.

Ostrea haitensis Sowerby.

Ostrea haitensis Sowb., Q. J. Geol. Soc., vi, 1849, p. 53.

Ostrea haytensis Sby., Gabb, Trans. Amer. Philos. Soc., xv, p. 257.

It attains a length up to $14\frac{1}{2}$ cm.

Ostrea frons L.

O. frons L., Gabb, Trans. Amer. Philos. Soc., xv, p. 258.

Two valves, no. 2639, do not appear distinguishable from the recent mangrove oyster.

Ostrea vaughani insularis Pilsbry and Brown.

Ostrea vaughani insularis Pils. and Brn., Proc. A. N. S. Phila, 1917, p. 40, pl. 6, figs. 1, 1a.

Ostrea virginica Gmel., in part, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 267.

Type is in no. 2635 A. N. S. P. No. 2634 contains young specimens.

Ostrea cahobasensis Pilsbry and Brown.

Ostrea cahobasensis Pils. and Brn., Proc. A. N. S. Phila. 1917, p. 40, pl. 6, fig. 8.

Ostrea virginica Gmel., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 257.

Numerous large and solid valves apparently belong to this species, described from Haiti.

Ostrea bolus Pils. and Johns. Plate XLIII, figs. 2, 3.

Proc. A. N. S. Phila. 1917, p. 192.

ANOMIIDAE.

Anomia sp. undet.

A subcircular valve of 19 mm. diameter in which the muscle impressions are not visible. Externally there is an excessively minute and delicate sculpture of radial striae, visible only near the borders. It is extremely similar to young shells of *Anomia lisbonensis* Aldrich of the same size. The sculpture of the recent *A. aculeata* is far coarser.

Anomia gabbi Pils. and Johns. Plate XLIII, fig. 1.

Proc. A. N. S. Phila. 1917, p. 193.

PECTINIDAE.

A single specimen identified by Gabb as *Pecten magnificus* Sby. (p. 256) appears to be *P. nodosus* L., as Dr. Dall has stated (Trans. Wagn. Inst. III). It retains the color almost as in a living shell. We are much disposed to think that it may be Pleistocene. The

shell was not collected by Gabb personally, and nothing is known of its stratigraphic position.

Doctor Dall has recorded *Pecten cactaceus* Dall from "Tertiary of Santo Domingo, Gabb"; but the species is not represented in this collection. The same is true of *Pecten (Plagioctenium) gabbi* Dall.

Pecten soror (Gabb) Plate XLIV, figs. 1, 2.

Janira soror Gabb, Trans. Amer. Philos. Soc. xv, 1873., p. 257.

Gabb's description was from right and left valves of two individuals. His measurement is from the concave valve catalogued under no. 2862, which may be considered type. It has about 19 rounded ribs (not counting a few very faint ones on the submargins) parted by wider intervals, the whole elegantly sculptured with close, regular and delicate concentric laminae (fig. 2). Alt. 47 mm.

The convex valve has 23 strong ribs, slightly wider than their intervals, somewhat flattened, and with similar concentric sculpture.

Length 42.5, alt. 40.5, convexity 14.5 mm.

There are also valves of several smaller individuals showing the same characters.

Pecten thetidis Sowerby. Plate XLIV, figs. 3, 6.

Pecten thetidis Sowb., Q. J. Geol. Soc., vi, 1849, p. 52. Not *Pecten (Aequipecten) thetidis* Sowerby, Dall, Trans. Wagn. Inst. iii, p. 714.

Pecten eugrammaticus Dall, Trans. Wagn. Inst. iii, p. 712, pl. 34, fig. 2.

The characteristic sculpture of this species has been well though briefly described by Sowerby, in terms preclude the identification of *thetidis* with a species of the *exasperatus* group, by Guppy and Dall.

The shell is rather convex, slightly inequilateral, with 21 ribs separated by V-shaped furrows. Except near the ends the ribs are square-topped, having flat or furrowed summits and more or less flange-like edges bearing unequal asperities. There is a beautiful sculpture of fine, nearly regular concentric threads over the furrows and slopes of the ribs. Submargins nearly or quite ribless. Ears are small, and have about 5 slender ribs. No ctenolium.

Length and alt. 24 mm.

The species here defined and figured is the only one in the large series which agrees with the Sowerby diagnosis. Gabb's collection covered the ground where the Heneken shells were obtained, and contains practically all of the Heneken species, so that it may fairly be inferred that the only species fulfilling the requirements of the original diagnosis is the true *thetidis*. It is not an uncommon shell,

and varies rather widely in the degree of development of the rib-ornamentation.

In a form of this species which may be called *Pecten thetidis pelei* (Plate XLIV, figs. 4, 5) the ribs have wider summits, more strongly developed spinose flanges, and on the slopes of the ribs there are one or two spinose riblets. The submargins and ears have a close sculpture of spinose riblets. Alt. and length 28, semidiam. 11 mm.

Type no. 2853 A. N. S. P.

Pecten plurinominis Pils. and Johns. Plate XLV, figs. 1, 2.

Proc. A. N. S. Phila. 1917, p. 193.

Pecten scissuratus Dall.

Pecten (Aequipecten) scissuratus Dall, Trans. Wagn. Inst. iii, p. 715, pl. 34, fig. 4. Brown and Pilsbry, Proc. A. N. S. Phila., 1911, p. 364, pl. 28, figs. 2, 5.

The sculpture is highly developed in this species.

Pecten interlineatus Gabb. Plate XLV, fig. 3.

Pecten interlineatus Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 256.

On the left valve there are 15 or 16 rounded and not very high major ribs, a riblet running in each interval; close to the base there are two or three in each interval. Anterior submargin with about six riblets, posterior ribs and riblets are granose. The anterior ear has few fine riblets, posterior ear coarse ribs. There is a fine concentric sculpture of regular hair-lines, but more or less wholly worn from the summits of the ribs. The right valve is a trifle less convex with the same sculpture except that both ears have fine riblets. Four well-developed teeth in the short ctenolium.

Length 23, alt. 24.7, diam. 7.2 mm.

Type no. 2856 A. N. S. P.

Pecten oxygonum Sowerby. Plate XLV, figs. 4, 5, 6.

Pecten oxygonum Sowb., Q. J. Geol. Soc., vi, 1849, p. 52.

A series of 26 valves seems to be referable to Sowerby's species. Doctor Dall has shown that neither of the specimens now preserved in the typical tray of Sowerby's collection agree with the diagnosis.

The 18 or 19 ribs have either distinctly angular or very narrowly rounded summits. There are fine, thread-like concentric striae. Submargins plain. The left valve is more convex than the right. There is no ctenolium.

Length and alt. 26.3, convexity 7.2 mm. (Left valve figured).

Pecten angusticostatus Gabb, Plate XLV, figs. 7, 8.

Pecten angusticostatus Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 256.

The sole specimen of this species is a left valve. It has 22 ribs. These are very high and acute, in section like an inverted V. Their slopes and intervals have an extremely fine, regular raised concentric striation. The anterior submargin has several very low ribs, and there are a few delicate riblets on the adjacent ear.

Length 24.3, alt. 23.8, convexity 8 mm.

Type no. 2866 A. N. S. P.

While this species is closely related to the preceding, it should be retained distinct until connecting specimens are found. It differs by the more numerous, far sharper ribs, the low ribs on the anterior submargin, the greater convexity, and the finer concentric striation.

There cannot be much doubt that the name as printed is an error for *angusticostatus*. Gabb was in Costa Rica when his paper was printed, and did not see the proofs.

Pecten uselmæ Pils. and Johns. Plate XLV, fig. 9.

Proc. A. N. S. Phila. 1917, p. 194.

Bowden, Jamaica. Type no. 11124 A. N. S. P.

Pecten inaequalis Sowerby. Plate XLV, fig. 11.

Pecten inaequalis Sowerby, Q. J. Geol. Soc., vi, 1849, p. 52. Not *P. inaequalis* of Guppy or of Dall.

This is an abundant *Aequipecten* in the collection. It is nearly equilateral, distinctly inequivalve. There are rounded ribs and concave intervals in both valves, the ribs in the left valve as wide as the intervals, in the right valve decidedly narrower. The greatest number of specimens have 19 ribs; many have 20 and the extremes, represented by a few, are 18 and 22 ribs. A very fine concentric sculpture of hair-like threads runs over both ribs and intervals, but is usually a good deal worn.

Length 38.5, alt. 37.3 mm.

The figures represent both valves of one individual. So far as we know, the species has been found only in Santo Domingo.

Pecten eccentricus Gabb. Plate XLV, fig. 12.

Pecten eccentricus Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 256.

Pecten (Plagiectenium) excentricus Gabb, Dall, Trans. Wagn. Inst., iii, p. 717.

This species is distinctly inequilateral. The type has 21 ribs, separated by wide, rather shallow intervals, and sculptured with very fine, close concentric threads, mainly lacking anteriorly. The

narrow tops of the ribs are a little flattened. Ears wanting in the type. It is a good deal like the right valve of *P. inaequalis* except that it is inequilateral.

Length 32, alt. 30 mm.

Type no. 2854 A. N. S. P.

Pecten (Amusium?) correctus Pils. and Johns. Plate XLV, fig. 13.

Pecten opercularis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 256.

Pecten correctus Pils. and Johns. Proc. A. N. S. Phila. 1917, p. 194.

Pecten ischnon Pils. and Johns. Plate XLIV, figs. 7, 8 (type), 9.

Proc. A. N. S. Phila. 1917, p. 194.

The concentric lineolation appears to be confined to the more convex valve.

Amusium papyraceum Gabb. Plate XLIII, figs. 8, 9.

Pleuromectia papyracea Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 257.

Smooth, with unsculptured beaks. The flatter valve is gently convex in the middle, with a broad, shallow concavity on each side. The type measures: Alt. 52, length 54 mm.

Type no. 2864 A. N. S. P.

SPONDYLIDAE.

Spondylus bostrychites Guppy.

Spondylus bifrons Sowerby, Q. J. Geol. Soc., vi, p. 53. Not of Goldfuss, 1835.

Spondylus bostrychites Guppy, Proc. Sci. Soc., Trinidad 1867, p. 176. Gabb, Trans. Amer. Philos. Soc., xv, p. 257. Dall, Trans. Wagn. Inst., iii, p. 758; Bull. 90, U. S. N. M. p. 124.

Abundant, and in fine preservation.

Spondylus gumanomocon Brown and Pilsbry. Plate XLIII, figs. 4, 5.

Spondylus americanus Lam., Gabb, Trans. Amer. Philos. Soc., xv, p. 257.

Spondylus gumanomocon Brown and Pilsbry, Proc. A. N. S. Phila., 1912, p. 514, footnote 4.

Type no. 2869 A. N. S. P.

A ponderous, very large species. The figures are much reduced.

Plicatula gibbosa Lamarck (variety).

Plicatula cristata Lam., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 257.

The single perfect specimen reported by Gabb appears to be identical with this common recent species, except that in places *fine radial striation* or crinkling may be seen under the lens. No color markings are preserved.

DIMYACIDAE.

Dimya grandis Dall.

Dimya grandis Dall, Proc. U. S. Nat. Mus., xix, p. 328, with var. *divaricata*; Trans. Wagn. Inst., iii, p. 764, pl. 35, fig. 8.

Three valves of the typical form and two of var. *divaricata* were found among unassorted oyster valves.

MYTILIDAE.

Modiolaria sp. undet.

Modiola sp. Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 252.

Two very small valves (length about 3.25 mm), belong apparently to the typical section of *Modiolaria*.

Modiolus sp. undet.

An internal cast, found with the following species.

Lithophaga antillarum Orbigny.

Lithodomus corrugatus Phil., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 253.

These mussels were preserved in their burrows. They appear typical of the species.

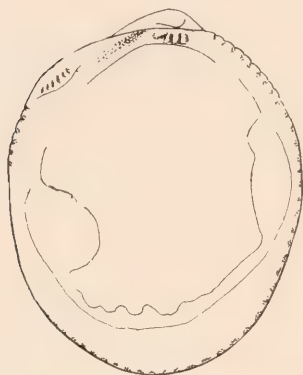


Fig. 37. *Crenella diuturna*.

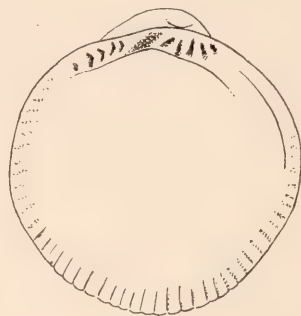


Fig. 38. *Crenella rota*.

Crenella diuturna Pils. and Johns. Text-fig. 37; Plate XXXVIII, fig. 7.

Proc. A. N. S. Phila. 1917, p. 195.

Crenella rota Pils. and Johns. Text-fig. 38.

Proc. A. N. S. Phila. 1917, p. 195.

PANDORIDAE.

Pandora inconspicua Gabb. Plate XXXVIII, figs. 8, 9.

Pandora inconspicua Gabb, Trans. Amer. Philos. Soc. xv, 1873, p. 248.

Convex (fig. 8) and flat (fig. 9) valves are photographed. The former is selected as type; length 7, alt. 3.3 mm.

Type and paratypes are no. 2676 A. N. S. P.

CUSPIDARIIDAE.

Cuspidaria ornator Pils. and Johns. Plate XXXVIII, figs. 11, 12.

Proc. A. N. S. Phila. 1917, p. 195.

Cuspidaria gabbi Pils. and Johns. Plate XXXVIII, fig. 10.

Proc. A. N. S. Phila. 1917, p. 195.

Very similar to *C. islahispaniolæ* Maury, but the figure of that shows a longer rostrum.

CRASSATELLITIDAE.

Crassatellites reevei (Gabb).

Crassatella antillarum Reeve? (*C. reevei* Gabb), Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 252.

Crassatellites reevei Gabb, Brown and Pilsbry, Proc. A. N. S. Phila. 1912, p. 515, pl. 23, fig. 5.

Type is no. 2687 A. N. S. P.

Crassatellites (Crassinella) guppyi radiata n. subsp. Plate XXXVIII, fig. 4.

The shell is similar to *C. guppyi* Dall in having narrow concentric ribs (twelve in number in the type), and in having a distinct microscopic concentric striation over ribs and intervals, but it differs from Bowden *guppyi* compared by having a fine, even radial striation, barely visible under a good hand lens, the striae impressed, cutting the concentric striation and passing over ribs and intervals.

Length 3.55, alt. 3.35, semidiam. 0.9 mm.

Type no. 3994 A. N. S. P.

Crassatellites (Crassinella) microdelta Pils. and Johns. Text-fig. 40.

Proc. A. N. S. Phila. 1917, p. 196.

Crassatellites (Crassinella) dolatus Pils. and Johns. Text-fig. 39.

Proc. A. N. S. Phila. 1917, p. 196.

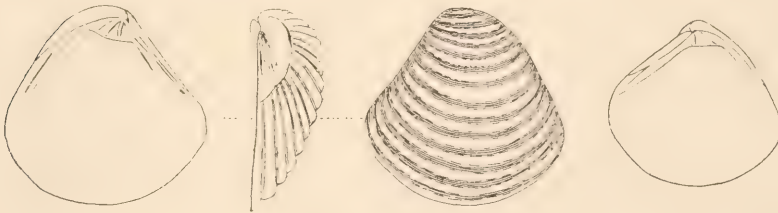


Fig. 39. *Crassatellites dolatus*.

Fig. 40. *C. microdelta*.

Venericardia aversa Pils. and Johns. Plate XLV, fig. 10.

Proc. A. N. S. Phila. 1917, p. 196.

Venericardia santodomingensis Pils. and Johns. Plate XLV, fig. 14.

Proc. A. N. S. Phila. 1917, p. 197.

CHAMIDAE.

Chama chipolana Dall.

Chama macrophylla Chemn., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 251.

Chama chipolana Dall, Trans. Wagn. Inst., iii, p. 1398; Bull. U. S. Nat. Mus. 90, p. 135, pl. 25, figs. 9, 11.

One characteristic valve.

Chama tampaensis Dall.

Chama tampaensis Dall, Trans. Wagn. Inst., iii, 1903, p. 1398, pl. 54, fig. 6; Bull. 90, U. S. N. M., p. 135, pl. 24, fig. 1.

One specimen, the valves together, agrees with Tampa examples.

Chama involuta Guppy.

Chama involuta Guppy, Geol. Mag. Dec. ii, vol. i, 1874, p. 444, pl. 17, figs. 5a-c.

Five characteristic valves, like Guppy's fig. 5c, and agreeing with Bowden examples.

This and the two preceding species were labelled *Chama macrophylla* in the Gabb collection. They have been compared carefully with numerous specimens from type localities of the respective species.

Echinochama yaquensis trachyderma Pils. and Johns. Plate XLVI, figs. 1, 2.

Echinochama trachyderma P. and J., Proc. A. N. S. Phila. 1917, p. 197.

Echinochama antiquata Dall, Maury, Bull. Amer. Pal. V, pl. 33, fig. 10.

A smaller form with fewer, less prominent radial ribs has been named *Echinochama antiquata* var. *yaquensis* Maury. A few of these are in the Gabb collection. The larger form with more ribs which we named *trachyderma* should apparently be called *C. yaquensis trachyderma*.

Type 2786 A. N. S. P.

LUCINIDAE.

Phacoides riocanensis Maury.

Lucina jamaicensis Chemn., Gabb, Trans. Amer. Philos. Soc., xv, p. 251.

Three fine specimens (no. 2666), the largest with an altitude of 84 mm. Very close to *P. hillsboroensis* (Heilpr.).

Phacoides perplexus Pils. and Johns. Text-fig. 41. Plate XXXVIII, fig. 3.

Phacoides perplexus Pils. & Johns., Proc. A. N. S. Phila. 1917, p. 197.

Lucina antillarum Reeve, Gabb, Trans. Amer. Philos. Soc., xv, p. 251.

This species has fewer radial ribs than *P. actinus* Dall, and their intervals are quite shallow. The lunule in the left valve is semi-cordiform, being about half as wide as long.

Phacoides (Parvilucina) pupulus Pils. and Johns. Text-fig. 42; Plate XXXVIII fig. 2.

Phacoides (Parvilucina) pupulus P. & J., Proc. A. N. S. Phila. 1917, p. 198.

Lucina crenulata Con., Gabb, Trans. Amer. Philos. Soc., xv, p. 251.

Phacoides (Lucinisca) muricatus (Spengler)

Lucina tigerina Linn., Gabb, Trans. Amer. Philos. Soc., xv, p. 251.

Phacoides (Lucinisca) muricatus Spengler, Dall, Trans. Wagn. Inst., iii, p. 1373.

Six specimens, no. 3162, appear to us identical with this recent species.

Phacoides (Parvilucina) yaquensis (Gabb)

Lucina yaquensis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 251.

Phacoides (Parvilucina) yaquensis Gabb, Dall, Trans. Wagn. Inst., iii, p. 1382.

The sculpture is of delicate, raised, concentric lines and almost obsolete radials. Length 3.8, alt. 3.5 diam. of a right valve 1.2 mm. Type no. 2772 A. N. S. P. There are many other valves in the lot.



Fig. 41. *Phacoides perplexus* P. and J. Fig. 42. *Phacoides pupulus* P. and J.

Lucina janus Dall.

Lucina janus Dall, Trans. Wagn. Inst., iii, p. 1353, pl. 51, fig. 9.

A number of specimens show variation in degree of inflation, but none are so nearly spherical as *L. corpulenta* Dall. I have had the advantage of a comparison with the Chipolan type by Doctor Dall.

Lucina mauryæ Pils. and Johns. Plate XLVI, fig. 3.

Proc. A. N. S. Phila. 1917, p. 198.

The dimensions of the type should be, length 36.3, alt. 33.5. diam. 18.5 mm. It becomes a little larger.

Lucina bulla (Gabb) Plate XLVI, fig. 6.

Cardium (Serripes) bulla Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 251.

The somewhat prosogyrate beaks are a little in front of the middle. There is an extremely narrow and small lunule. The surface is somewhat roughened by growth-lines; on the posterior and anterior

slopes the rugosity is greater. Posteriorly a few minute short wrinkles run more obliquely towards the basal margin. In suitable light, very weak traces of radial sculpture are discernible. It was probably very little alate in front of the beaks, but the shell is broken away there.

Length 44, alt. 40, diam. 23.7 mm.

Type no. 2763 A. N. S. P.

The type is an excellent specimen except for some breakage of the anterior margin. The hinge is not visible, but the characters, so far as shown, are those of a Lucinid shell and not of a *Cardium*.

There is also a broken and distorted specimen.

Divaricella proleteria Pils. and Johns. Plate XLII, fig. 1, 2.

Divaricella proleteria P. & J., Proc. A. N. S. Phila. 1917, p. 198.

Lucina dentata Wood, Gabb, Trans. Amer. Philos. Soc., xv, p. 251.

D. prevaricata Guppy is of the same size, but according to Dall's figure of the type (Proc. U. S. N. Mus., XIX, plate XXX, fig. 4) it has closer divaricating grooves.

DIPLDONTIDAE.

Diplodonta (Phlyctiderma) gabbi Dall. Text-fig. 43.

Mysia subquadrata Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 252. Not

Diplodonta subquadrata Carpenter, P. Z. S., 1855, p. 230.

D. [iplodonta] gabbi Dall, Trans. Wagn. Inst., iii, p. 1183, footnote.

Diplodonta (Phlyctiderma) puncturella Dall, *t. c.*, p. 1183.

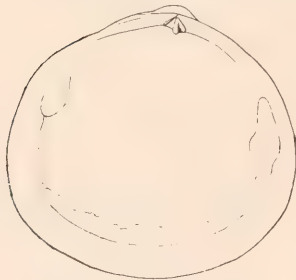


Fig. 43. *Diplodonta gabbi* Dall. Type.

Externally this species has an extremely minute, irregular but dense punctation, the pits more or less anastomosing, forming a sort of network where most perfectly preserved. There is some variation in contour, some examples having the anterior end less rounded than that figured. The largest valve (figured) measures, length 5.6, alt. 5.4, diam. 1.65 mm.

Type is no. 2693 A. N. S. P.

We have not compared specimens of the Bowden *D. puncturella* Dall, which from the description and figure appears not to differ from *gabbi*. Dall had not seen the latter, apparently.

Diplodonta dedecoris n. sp. Text-fig. 44*d.e.*

Proc. A. N. S. Phila. 1917, p. 198.

Diplodonta (Sphærella) capuloides (Gabb) Text-fig. 44a, b, c.

Mysia capuloides Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 252.

The shell is much inflated, with sculpture of very minute, but well developed concentric striae. Beaks large and prominent. The right anterior and posterior cardinal teeth are both bifid. The edge of the valve is noticeably reflected upward above the cardinal teeth.

Length 5.2, alt. 5, semidiam. 2.4 mm.

Type and two paratypes no. 2694 A. N. S. P. All are right valves. On account of the inflated form and peculiar hinge this species appears to belong to the subgenus *Sphærella* Conrad.

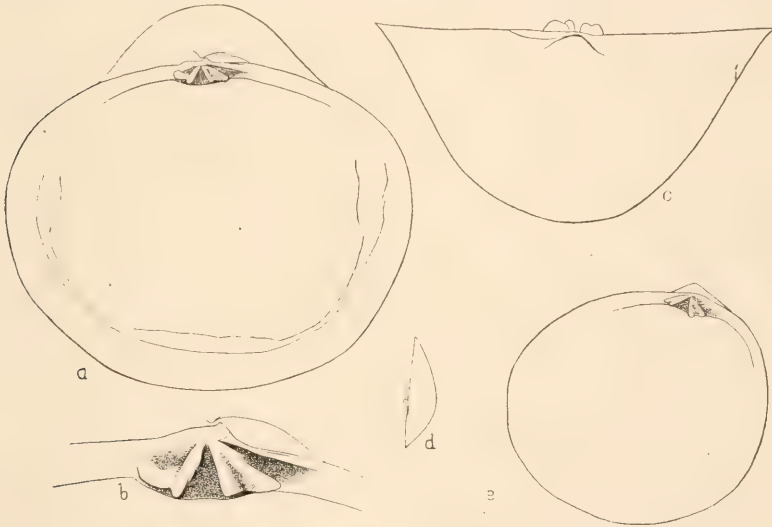


Fig. 44. a, b, c. *Diplodonta capuloides* Gabb; d, e, *D. dedecoris* P. and J.

SPORTELLIDAE.

Sportella lioconcha Dall.

Sportella lioconcha Dall, Trans. Wagner Inst., iii, p. 1128, pl. 44, fig. 24 (Oligocene sands of Oak Grove, Florida).

A valve agreeing with this species measures, length 11.5, alt. 8, semidiam. 2.6 mm.

Neæromya quadrata (Gabb) Text-fig. 45a-e.

Neæromya quadrata Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 247; Proc.

A. N. S. Phila. 1872, p. 274, pl. 10, figs. 4, 1a, 4b.

Neæromya (= *Erycina*) *quadrata* Gabb, Dall, Trans. Wagner Free Inst. Sci., iii, pt. 5, p. 1140, 1143.

Besides some fragments, there are in Gabb's type lot three specimens showing the hinge. Two of these, the originals of Gabb's figures

1a, 4b, are redrawn. The valve shown in fig 45 a, b, c, may be taken as type of the species and genus. The lateral teeth described and figured by Gabb do not exist, the surfaces where they would stand being flat. The hinges of small Leptonid bivalves are hard to make out, and we attribute Gabb's mistake to the use of a low-power hand lens, instead of the compound microscope.

The external surface shows an extremely minute radial rugosity, or irregular lineolation, under high magnification. Concentric sculpture is very slight. The prodissoconch has a circular outline, like that of *Sportella* (fig. e).

Length 6.2, alt. 4.2 mm. (Fig. 45 a).

It is plain that the species is not a typical *Erycina*; the hinge being more like *Pseudopythina* or *Sportella*. Not being expert in the study of Leptonacea, the species is left under the original generic name.

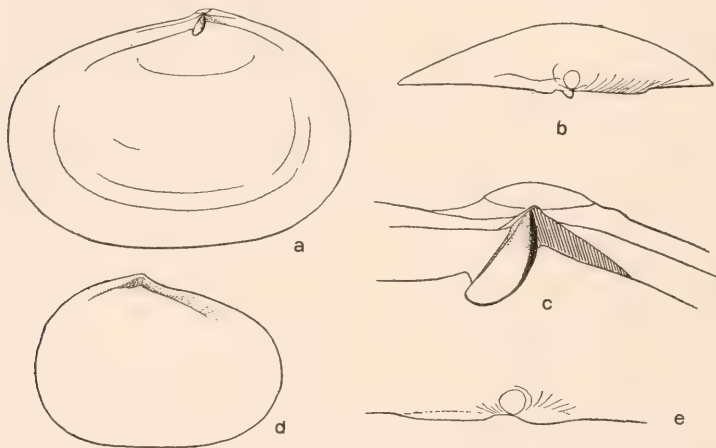


Fig. 45. *Neeromya quadrata* Gabb, a, b, interior and dorsal views of right valve, type; c, enlarged cardinal detail of same; d, e, interior and dorsal views of a smaller left valve.

Type no. 2787 A. N. S. P.

CARDIIDAE.

We may note in this connection that by a typographical error *Cardium durum* was spelled *durun* in Proc. A. N. S. Phila. 1912, p. 516. It was correctly spelled on pp. 501 and 519.

Cardium (*Trachycardium*) *dominicanum* Dall.

Cardium (*Trachycardium*) *dominicanum* Dall, Trans. Wagn. Inst., iii, p. 1082, pl. 48, fig. 16.

C. (Trachycardium) subelongatum Sby., Gabb, Trans. Amer. Philos. Soc., xv, p. 250.

Cardium (Trachycardium) dominicense Gabb. Plate XXV, figs. 8, 9.

Cardium dominicense Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 250; Journ. A. N. S. Phila. viii, p. 344. Pilsbry and Brown, Proc. A. N. S. Phila., 1911, p. 367 (Gatun).

The ribs, except on the posterior slope, are smooth and rounded, separated by narrow grooves. On the anterior end the ribs show small erect processes or the scars where they have been. There are also quite small processes along the posterior sides of the rest of the ribs, nearly all worn off. On the posterior area each rib is split, alternate ones of the resulting riblets bearing erect, oblique processes. The posterior end is deeply serrate, each primary rib projecting. There are about 54 primary ribs.

The whole basal margin is broken away, so that the true length does not show in the figure. The type measures: length 38, alt. 44 (estimated), diam. of one valve 15 mm.

Several young shells are more rounded in outline, and the ribs are very closely spinose towards the margins. The posterior ribs show only a trace of splitting. (No. 2769 A. N. S. P.).

Type no. 2764 A. N. S. P.

Cardium linguatigris Maury appears to resemble this species rather closely.

Cardium tintinnabularum Maury.

One imperfect valve.

Cardium (Trigoniocardia) haitense Sowerby.

Cardium haitense Sowerby, Q. J. Geol. Soc., vi, 1849, p. 52, pl. 10, fig. 11.

C. (Fragum) haitense Sby., Gabb, Trans. Amer. Philos. Soc., xv, p. 251.

Cardium (Laevicardium) serratum L.

Cardium (Laevicardium) serratum L., Dall, Trans. Wagn. Inst., iii, p. 1112.

Not recorded by Gabb, who left the specimens without name. They are rather small, alt. 23 mm., but characteristic.

Cardium (Laevicardium) venustum Gabb. Plate XXV, figs. 2, 7.

C. (Laevicardium) venustum Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 251.

The shell is longer than high, transversely oval, with very convex, but somewhat narrow and markedly prosogyrate beaks, which project far more above the hinge outline than in *C. serratum*. The anterior and posterior areas are smooth, the median portion finely ribbed, the ribs low, flattened, much wider than the intervals, which are closely and finely striated transversely. There are about 50 ribs. The right anterior cardinal tooth is peg-like, higher than the posterior. Lateral teeth compressed, the posterior, especially, much thinner than in *C. serratum*.

Length 33, alt. 31, diam. of one valve 13 mm.

Type no. 2768 A. N. S. P.

This species has been placed in the synonymy of *C. serratum*, but it seems to me distinct by the far larger beaks, of a different shape, and the differences in the teeth. In *C. serratum* the beaks are much wider and lower, even in specimens of far greater size. The sculpture described may possibly be due to disintegration of the outer layer, though we see no evidence that this is the case.

VENERIDAE.

Macrocallista (Chionella) maculata (L.)

M. (C.) maculata L., Dall, Trans. Wagn. Inst., iii, p. 1256.

Agrees closely with recent specimens externally. As the valves are together the interior could not be compared.

Macrocallista (Chionella) planivieta (Guppy)

Cytherea (Callista) planivieta Guppy, Q. J. Geol. Soc., xxii, 1866, p. 292, pl. 18, fig. 3.

Callista planivieta Guppy, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 250.

One typical right valve (no. 2670).

Pitar tryonianus (Gabb) Plate XLVII, fig. 11.

Callista tryoniana Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 250.

This shell is not unlike the recent *P. fulminata* Mke. (*varians* Hanley), but is thinner, a little plumper, with the beaks turned forward a little more. The sculpture is of very fine, close, even and smooth concentric threads, which are flattened and wider in the median part, where unworn; the beaks smooth in the median convexity. The lunule is defined by a weakly impressed line.

Length 28, alt. 23.3, semidiameter 8.4 mm.

Type no. 2757 A. N. S. P.; a left valve.

Cf. *Pitaria cercadica* Maury, which appears to be the same species.

The emendation of *Pitar* into *Pitaria* was an arbitrary proceeding. There are many non-Latin generic and specific names which might equally well be changed to give them a Latin dress.

Pitar (Hyphantosoma) carbaseus (Guppy)

Cytherea (Circe) carbasea Guppy, Q. J. Geol. Soc., xxii, 1866, p. 292, pl. 18, fig. 13.

Callista carbasea Guppy, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 250.

Pitaria (Hyphantosoma) carbasea Guppy, Dall, Trans. Wagn. Inst., iii, p. 1266.

Six specimens contained in trays no. 2664 and 2679.

Pitar (Lamelliconcha) acuticostatus (Gabb) Plate XLVII, fig. 10.

Callista acuticostata Gabb, Tr. Amer. Philos. Soc. xv, 1873, p. 250.

The sculpture consists of close, nearly equal, thin concentric ribs

of which every second one rises lamina-like at the anterior end. The lunule is quite small, marked by a rather weak impressed line. The pallial sinus is horizontal, rounded at the end, and reaches beyond the middle of the length.

Length 25.5, alt. 22, semidiameter 7.2 mm.

Type is no. 2776 A. N. S. P., a left valve. A series of smaller valves is contained in no. 2775.

This shell is shorter and more acutely sculptured than *P. concinnus* Sowb.

Cytherea (Antigona) tarquinia (Dall)

Venus magnifica Hanley, Gabb, Tr. Amer. Philos. Soc. xv, p. 259.

Venus tarquinia Dall, Trans. Wagn. Inst., iii, p. 1194, pl. 38, fig. 2. (Ballast Point, Florida).

Cytherea tarquinia Dall, t. c. p. 1274.

Antigona tarquinia Dall, U. S. Nat. Mus., 90, p. 147.

Fine specimens, up to a length of 77 mm. It is probably ancestral to the recent *C. listeri*, in which the concentric sculpture is much more strongly developed.

While *Cytherea magnifica* is related, it differs by the wider, flatter radial striae.

Chione (Lirophora) pappia (L.)

Chione pappia Linn., Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 249.

? *Chione (Lirophora) hendersonii* Dall, Trans. Wagn. Inst., iii, p. 1295.

Five valves, no. 2669. We cannot distinguish them from the recent species. Numerous specimens from Jamaica (no. 11041), which are apparently referable to *C. hendersonii* Dall, do not seem to be specifically distinct.

Chione santodomingensis Pils. and Johns. Plate XLVII, figs. 1, 2.

Proc. A. N. S. Phila. 1917, p. 199.

Chione socia Pils. and Johns. Plate XLVII, figs. 12, 13.

Proc. A. N. S. Phila. 1917, p. 199.

Chione primigenia Pils. and Johns. Plate XLVII, figs. 6, 7.

Proc. A. N. S. Phila. 1917, p. 199.

Chione guppyana Gabb. Plate XLVII, figs. 3, 4, 5.

Chione guppyana Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 249.

A peculiarity of this species is that the ventral faces of some or all of the concentric lamellae have about twice as many ribs as there are in the intervals. This is shown in the detail photographed in fig. 4. It is a rather plump, rounded shell, related to *C. woodwardi* Guppy.

Length 31.3, alt. 30 mm. Type no. 2773.

Length 32.5, alt. 29, diam. 22.3 mm.

Cytherea (Ventricola) blandiana (Guppy)

Chione circinata Born, Gabb, Trans. Amer. Philos. Soc., xv, p. 250.

Venus blandiana Guppy, Geol. Mag. Dec. 11, vol. i, 1874, p. 444, pl. 17, fig. 8.

Cytherea (Ventricola) blandiana Guppy, Dall, Trans. Wagn. Inst., iii, p. 1277.

This fine species reaches a length of 43 mm. Guppy's figure is very inadequate.

Cyclinella cyclica domingensis Pils. and Johns. Plate XLVII, fig. 8.

Proc. A. N. S. Phila. 1917, p. 200.

Dosinia azuana Pils. and Johns. Plate XLVII, fig. 9.

Proc. A. N. S. Phila. 1917, p. 200.

TELLINIDAE.**Tellina** sp. undet.

? *Tellina punicea* Born, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 248.

An imperfect internal cast in a hard rock, no. 2788, resembles this species in outline but is more convex. It was not labelled, but may possibly represent Gabb's *T. punicea*. No specimens were found under that name in the collection.

Tellina (Eurytellina) n. sp.

A weakly grooved left valve, which has been broken into several pieces and repaired, apparently belongs to an undescribed species. It is no. 3200 A. N. S. P.

Tellina alternata Say.

Tellina alternata Say, Gabb, Trans. Amer. Philos. Soc., xv, p. 248.

There is a set of *T. alternata* in the collection labelled "U. S." possibly from Santo Domingo or Costa Rica, but without Gabb's MS. label. We cannot, therefore, confirm or reject Gabb's record. This and *T. punicea* are the only species mentioned by Gabb which we have not been able to trace in the collection.

Tellina minuta Gabb. Text-fig. 46a, b.

Tellina (Peronæoderma) minuta Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 249.

The shape is subcircular rather than "suboval". Left valve without lateral teeth, and a little plumper than the right. Externally there are very fine, evenly spaced concentric lines with flat intervals, much as in *T. alternata* except that the sculpture is very flat and superficial. It is quite thin, and the internal impressions are faint.

Length 5.5, alt. 4.75 mm.

Type no. 2789 A. N. S. P.

Semele delimata Pils. and Johns. Plate XLVI, fig. 9.

Proc. A. N. S. Phila. 1917, p. 200.

Semele firma Pils. and Johns. Plate XLVI, fig. 10.

Proc. A. N. S. Phila. 1917, p. 200.

Tellina (Merisca) errati Pils. and Johns. Plate XLI, fig. 7.

Proc. A. N. S. Phila. 1917, p. 201.

Tellina (Moerella) simpsoni Dall.

T. (M.) simpsoni Dall, Trans. Wagn. Inst. iii, p. 1024, pl. 46, fig. 12.

According to Dall, "this form is what Gabb identified as *T. cuneata* d'Orb." but in the vial labelled *T. cuneata* (no. 2663) we find only a worn valve of some Erycinid form.



Fig. 46. *Tellina minuta* Gabb; inside and exterior of the type valve.

Tellina (Cyclotellina) fausta Donovan.

T. (Arcopagia) fausta Don., Gabb, Trans. Amer. Philos. Soc., xv, p. 249.

The outside of a single almost perfect specimen (no. 2695) does not differ materially from this recent species. As the valves are closed, no details of the interior are accessible.

Metis efferta Pils. and Johns.

Proc. A. N. S. Phila. 1917, p. 201.

Metis chipolana Dall (?). Plate XLVI, fig. 7.

Metis chipolana Dall, Trans. Wagn. Inst., iii, 1900, p. 1042, pl. 47, fig. 21.

Tellina (Macoma) constricta Brug., Gabb, Trans. Amer. Philos. Soc., xv, p. 249.

A single Santo Domingan example (no. 2671) differs from the type by having the posterior end broader, the radial striation is less distinct, and the concavity of the right valve more extensive; yet we do not think it specifically separable. Length 37.3, alt. 32, diam. 15 mm.

Metis postrema Pils. and Johns.

Proc. A. N. S. Phila. 1917, p. 201.

Strigilla pisiformis (L.)

Strigilla pisiformis Linn., Gabb, Trans. Amer. Philos. Soc. XV, p. 249.

Abundant.

DONACIDAE.

Donax aequalis Gabb. Text-fig. 47.

Donax aequalis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 249.

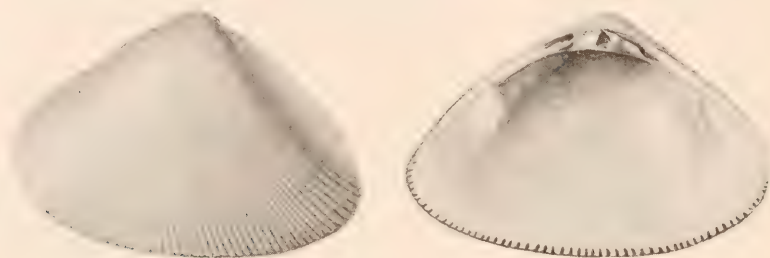


Fig. 47. *Donax aequalis* Gabb.

The shell is unusually equilateral for this genus. The type, a right valve, measures, length 7.8, alt. 5.5, semidiameter 2 mm. No. 2668 A. N. S. P.

SOLENIIDAE.

Siliqua subaequalis Gabb. Text-fig. 48.

S. subaequalis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 247.

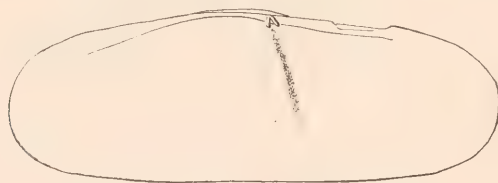


Fig. 48. *Siliqua subaequalis* Gabb.

This shell is extremely delicate and fragile. The rather strong internal rib extends two-thirds of the distance to the lower border. Length 19, alt. 7, semidiameter 1.5 mm.
Type and four other valves no. 2677 A. N. S. P.

MACTRIDAE.

***Mactra dariensis* Dall.**

Mactrella alata Spengler, Gabb, Trans. Amer. Philos. Soc., xv, p. 248.

Two specimens in hard gray rock, one an internal cast, the other retaining part of the shell, seem to be referable to this species described from the Oligocene of the Canal Zone. The best specimen has the sharp grooves on both sides of the beaks described by Dall, and the shape agrees well.

Gabb's identification was evidently hasty, as little resemblance to *M. alata* can be traced.

***Labiosa (Raeta) gabbi*.** Pils. and Johns. Plate XLVI, fig. 11.

Proc. A. N. S. Phila. 1917, p. 202.

CORBULIDAE.

***Corbula vieta* Guppy.**

Corbula disparilis d'Orb., Gabb, Trans. Amer. Philos. Soc., xv, p. 247.

Corbula vieta Guppy, Quart. Journ. Geol. Soc., xxii, p. 580, pl. 26, fig. 8.

Dall, Trans. Wagn. Inst. iii, p. 849.

Erycina tensa Guppy, Q. J. Geol. Soc., xxii, p. 582, pl. 22, fig. 6, (left valve).

Gabb, Trans. Amer. Philos. Soc., xv, p. 252.

Gabb considered *vieta* to be identical with *disparilis*; the resemblance is certainly great, but according to Dr. Dall, the small differential features are constant.

***Corbula sericea* Dall.**

Corbula lavaleana d'Orb., Gabb, Trans. Amer. Philos. Soc., xv, p. 247.

Corbula sericea Dall, Tr. Wagn. Inst., iii, p. 848, pl. 36, fig. 8.

***Corbula knoxiana fossilis* n. subsp.** Plate XLVI, fig. 14.

Corbula contracta Say, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 247.

Not of Say.

The specimens agree well in form with *C. knoxiana* C. B. Ad. except that the carina projects decidedly less. The type, a right valve, measures length 8.7, alt. 6, diam. 3 mm.

Type no. 2689 A. N. S. P.

***Corbula dominicensis* Gabb.** Plate XLVI, figs. 12, 13.

Corbula dominicensis Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 247.

The right valve is slightly larger. Sculpture of concentric ribs, abrupt on their upper edges, sloping on the lower. On the posterior half the number of ribs is nearly doubled, by splitting. In the left valve the ribs are simple throughout, not split posteriorly.

Ridge to the sharp posterior angle is acute.

Length 14.6, alt. 9, diam. 6 mm.

Type is no. 2691 A. N. S. P.

Corbula (Bothrocorbula) viminea Guppy.

Bothrocorbula viminea Guppy, Gabb, Trans. Am. Philos. Soc., xv, p. 247.

Bothrocorbula viminea Guppy, Gabb, Proc. A. N. S. Phila. 1872, p. 274, pl. 10, figs. 3, 3a.

The specimens agree well with those of the Bowden bed.

GASTROCHAENIDAE.

Rocellaria sp. undet.

Rocellaria sp.? Gabb, Trans. Amer. Philos. Soc., xv, p. 246.

Two minute valves about 3 mm. long scarcely permit identification of species, though showing presence of the genus. No. 2678.

PHOLADIDAE.

Martesia sanctipauli Maury.

Martesia sp. *indet.* Gabb, Trans. Amer. Philos. Soc., xv, p. 246.

An imperfect valve is apparently referable to *M. sanctipauli*. The length of the specimen as broken is 3.7 mm. No. 2672 A. N. S. P.

TEREDINIDAE.

Teredo (Kuphus) incrassata (Gabb)

Kuphus incrassatus Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 249; Journ. A. N. S. Phila., viii, 1881, p. 342, pl. 44, figs. 12 a-c.

Type lot is no. 2785 A. N. S. P.

Teredo sp. undet.

? *Teredo* sp. *undet.*, Gabb, Trans. Amer. Philos. Soc., xv, 1873, p. 246.

Two groups of tubes about 10 mm. in diameter, in hard rock.

EXPLANATION OF PLATES XVI-XLVII.

Drawings, photographs and retouching by Helen Winchester. The line figures in the text were drawn by the author.

Plate XVI.—Fig. 1, 2.—*Drillia macilenta* Dall. Length 37.5 mm. and 44 mm.

Fig. 3.—*Drillia consors* Sowb. Length 41.5 mm.

Fig. 4, 5.—*Drillia squamosa* Gabb. Type. Length 56.5 mm.

Fig. 6.—*Drillia callistopleura* Pils. & Johns. Type. Length 22.4 mm.

Fig. 7, 8.—*Drillia winchesterae* n. sp. Type. Length 26.3 mm.

Fig. 9.—*Drillia elocata* n. sp. Type. Length 25.4 mm.

Fig. 10, 11.—*Clathurella gracilis* Gabb. Type. Length 28.3 mm.

Fig. 12.—*Drillia callistura* Gabb. Type. Length 21.7 mm.

Fig. 13.—*Drillia mimula* Pils. & Johns. Type. Length 16.7 mm.

Fig. 14.—*Drillia subgibbosa* Pils. & Johns. Cotype. Length 46 mm.

Fig. 15.—*Drillia ischnatracta* Pils. & Johns. Type. Length 53.4 mm.

Fig. 16, 17.—*Drillia scala* Pils. & Johns. Type. Length 45.4 mm.

Fig. 18.—*Drillia esculenta* Pils. & Johns. Type. Length 13.2 mm.

Fig. 19.—*Drillia orthopleura* Pils. & Johns. Type. Length 13.7 mm.

Fig. 20.—*Drillia foveolata* Pils. & Johns. Type. Length 14.1 mm.

Fig. 21.—*Drillia parkeri* Gabb. Type. Length 26.8 mm.

Plate XVII.—Fig. 1.—*Turris rara* Gabb. Type.

Fig. 2.—*Surcula longicaudata* (Gabb). Type.

Fig. 3.—*Drillia henekeni* (Sowb.).

Fig. 4, 5.—*Surcula humerosa* (Gabb). Type and paratype.

Fig. 6.—*Drillia sororcula* Pils. & Johns. Type.

Fig. 7.—*Drillia gatunensis alia* n. subsp. Type.

Fig. 8.—*Drillia fusiformis* (Gabb). Type.

Fig. 9.—*Cythara heptagona* (Gabb). Type.

Fig. 10.—*Cythara polygona* (Gabb). Type.

Fig. 11, 12.—*Clavatula labiata* Gabb. Type and paratype.

Fig. 13.—*Clathurella amica* Pils. & Johns. Type.

Fig. 14.—*Drillia venusta* (Sowb.).

Fig. 15.—*Glyphostoma dentiferum* Gabb. Type.

Fig. 16.—*Scobinella magnifica* (Gabb). Type.

Fig. 17, 18.—*Scobinella tristis* Pils. & Johns. Back and face of type.

Fig. 19, 20.—*Borsonia varicosa* Gabb. Views of opposite sides of the summit of a quite perfect paratype.

Fig. 21.—*Borsonia varicosa* Gabb. Type.

Plate XVIII.—Fig. 1.—*Drillia hexapleura* Pils. & Johns. Type. No. 2908.

Fig. 2.—*Borsonia recurvirostris* Gabb. Type. Length 9.6 mm.

Fig. 3.—*Cythara elevata* (Gabb). Type. No. 3224.

Fig. 4.—*Clathurella paupercula* (Gabb). Type.

Fig. 5.—*Drillia lissotropis dorsuosa* Pils. & Johns. Type.

Fig. 6.—*Cythara elongata* (Gabb). Type. No. 2917.

Fig. 7.—*Odostomia dulcis* Pils. & Johns. Type.

Fig. 8.—*Anachis* (?) *quadrata* (Gabb). Type. Length 8.7 mm.

Fig. 9.—*Strombina caribæa* Gabb. Type.

Fig. 10, 11.—*Strombina caribæa micra* Pils. & Johns. Type.

Fig. 12.—*Dentalium sagittarii* Pils. & Johns. Type.

Fig. 13.—*Anachis exilis* (Gabb). Type.

Fig. 14.—*Columbella inflata* (Gabb). Type. Length 25.6 mm.

Fig. 15.—*Strombina politissima* Pils. & Johns. Type.

Fig. 16.—*Metulella fusiformis* Gabb. Type. Length 18.5 mm.

Fig. 17.—*Anachis gracilicostata* Pils. & Johns. Type. No. 2803.

Fig. 18.—*Metulella dominicensis* Pils. & Johns. Type. Length 16.4 mm.

Plate XIX.—Fig. 1.—*Conus haytensis* Sowb. Length 107 mm.

Fig. 2.—*Conus recognitus* Guppy. Length 69 mm.

Fig. 3.—*Conus bonaczyi* Gabb. Type. Length 21.5 mm.

Fig. 4.—*Conus longitudinalis* Pils. & Johns. Type. Length 35 mm.

Fig. 5.—*Conus haytensis politispira* n. subsp. Type. Length 65 mm.

Fig. 6.—*Conus trisculptus* Pils. & Johns. Type. Length 34½ mm.

Fig. 7.—*Conus domingensis* Sowb. Length 89 mm.

Plate XX.—Fig. 1.—*Conus furvoides* Gabb. Type. Length 44.5 mm.

Fig. 2, 2a, 2b, *Conus symmetricus* Sowb. Lengths 25, 27.5 and 49 mm.

Fig. 3.—*Conus furvoides brachys* Pils. & Johns. Type. Length 37.5 mm.

Fig. 4.—*Conus aratus* Gabb. Type. Length 63 mm.

Fig. 5.—*Conus perlepidus* Pils. & Johns. Type. Length 44 mm.

Fig. 6.—*Conus planiliratus* Sowb. Length 32 mm.

Fig. 7, 7a, 7b.—*Conus consobrinus* Sowb. Length 27, 30 and 50 mm.

Fig. 8.—*Conus consobrinus ultimus* Pils. & Johns. Type. Length 52 mm.

Fig. 9.—*Conus planiliratus* Sowb. var. Length 42 mm.

Fig. 10.—*Conus cercadensis* Maury. (*porcellus* Pils. & Johns. Type). Length 29 mm.

Fig. 11, 11a.—*Conus xenicus* Pils. & Johns. Type and paratype. Lengths 28.5 and 27 mm.

Plate XXI.—Fig. 1.—*Conus stenostoma* Sowb. Length 75 mm.

Fig. 2.—*Conus strombiformis* Gabb. Type. Length 63 mm.

Fig. 3.—*Conus simplicissimus* Pils. & Johns. Type. Length 63 mm.

Fig. 4.—*Conus proteus humerosus* n. subsp. Type. Length 65 mm.

Fig. 5.—*Conus simplicissimus* n. subsp. Length 68 mm.

Fig. 6.—*Conus yaquensis* Gabb. Type. Length 49 mm.

Fig. 7.—*Conus pernodosus* Pils. & Johns. Type. Length 23 mm.

Fig. 8, 9.—*Conus gabbii* Pils. & Johns. Paratype and type. Lengths 33 and 42.5 mm.

Fig. 10.—*Conus larvatus* Pils. & Johns. Type. Length 33 mm.

Plate XXII.—Figs. 1, 2.—*Terebra hitia* Pils. & Johns., with detail of penult whorl.

Figs. 3, 4.—*Conus catenatus* Sowb. Lengths 65 and 28 mm.

Figs. 5, 6.—*Terebra baculiformis* Pils. & Johns., with detail of penult whorl.

Fig. 7.—*Cancellaria guppyi* Gabb. Type.

Figs. 8, 9.—*Cancellaria ellipsis* Pils. & Johns. Type and paratype.

Figs. 10, 14.—*Phos costatus* Gabb. Type and paratype. Lengths 31 and 30.5 mm.

Fig. 11.—*Cancellaria insularis* Pils. & Johns. Type.

Fig. 12.—*Cancellaria gabbiana* Pils. & Johns. Type.

Fig. 13.—*Cancellaria epistomifera* Guppy. Length 37 mm.

Fig. 14.—*Phos costatus* Gabb.

Fig. 15.—*Nassaria brevis* Gabb. Type. Length 20 mm.

Fig. 16, 17, 18.—*Phos guppyi* Gabb. Type and paratypes. Lengths 31.5, 28, 33.5 mm.

Figs. 19, 20.—*Metula cancellata* Gabb. Type. Length 24.5 mm.

Figs. 21, 22.—*Surcula jacquensis* (Gabb). Type and paratype. Lengths 45 and 67.3 mm.

Figs. 23, 24, 25. *Phos semicostatus* Gabb. Lengths 33.5, and 34. mm.

Fig. 23 is the type.

Plate XXIII.—Fig. 1.—*Oliva proavia* Pils. & Johns. Type.

Figs. 2, 3.—*Oliva cylindrica* Sowb. Lengths 35 and 31 mm.

Fig. 4.—*Oliva brevispira* Gabb. Type.

Fig. 5.—*Olivella canaliculata* Gabb. Type. (= *muticoides* var.).

Fig. 6.—*Olivella muticoides* Gabb, intermediate form. Length 17.3 mm.

Fig. 7.—*Olivella muticoides* Gabb. Type.

Fig. 8.—*Oliva dimidiata* Pils. & Johns. Type.

Fig. 9.—*Aurinia striata* Gabb. Type.

- Figs. 10, 11.—*Oliva gradata* Gabb. Paratype and type.
Fig. 12.—*Rictaxis oryza* (Gabb). Type. Length 6.7 mm.
Fig. 13.—*Harpa americana* n. sp. Type.
Fig. 14.—*Marginella sowerbyi* Gabb. Type.
Fig. 15.—*Acteon subornatilis* Pils. & Johns. Type.

Plate XXIV.—Fig. 1.—*Mitra symmetrica* Gabb. Type (= *titan* Gabb). Length 51 mm.

- Fig. 2.—*Mitra titan* Gabb. Type. Length 106 mm.
Fig. 3.—*Mitra longa* Gabb. Type. Length 61.3 mm.
Figs. 4, 5.—*Mitra rudis* Gabb. Type and a young specimen.
Fig. 6.—*Plochelea crassilabrum* Gabb. Type.
Fig. 7.—*Plochelea gabbi* Pils. & Johns. Type. Length 27.5 mm.
Fig. 8.—*Vexillum tortuosum* (Gabb). Type. Length 32.3 mm.
Fig. 9.—*Vexillum tortuosellum* (Pils. & Johns.). Type.
Fig. 10.—*Mitra mesolia* Pils. & Johns. Type.
Fig. 11, 12.—*Lyria soror* (Sowerby).
Fig. 13.—*Vexillum tortuosellum frater* (Pils. & Johns.). Type.
Fig. 14.—*Marginella nugax* Pils. & Johns. Type.

Plate XXV.—Fig. 1.—*Latirofuscus exilis* (Gabb). Length 31.4 mm.

- Fig. 2.—*Cardium venustum* Gabb. Type.
Fig. 3.—*Xancus validus* (Sowb.). Length 178 mm.
Fig. 4.—*Latirus brevicaudatus santodomingensis* P. Length 57 mm.
Fig. 5.—*Xancus textilis jamaicensis* Pils. & Johns. Length 123 mm.
Fig. 6.—*Xancus textilis jamaicensis*. Length 42 mm.
Fig. 7.—*Cardium venustum* Gabb. Type.
Fig. 8, 9.—*Cardium dominicense* Gabb. Type.

Plate XXVI.—Fig. 1.—*Latirus angustatus* Gabb. Length 27 mm.

- Fig. 2.—*Latirus fusiformis* Gabb. Length 31.5 mm.
Fig. 3.—*Latirus fusiformis* Gabb. Length 28.7 mm.
Fig. 4.—*Latirus elongatus* Gabb. Length 49 mm.
Fig. 5.—*Xancus rex* Pils. & Johns. Length 220 mm.
Figs. 6, 7.—*Fusinus henekenii* (Sowb.). Lengths 71 and 89 mm.
Fig. 8.—*Xancus rex* Pils. & Johns. Length 156 mm.
Fig. 9.—*Leucozonia rhomboidea* Gabb. Length 13.6 mm.

Plate XXVII.—Fig. 1.—*Vasum pugnus* Pils. & Johns. Length 80 mm.

- Figs. 2, 3.—*Vasum tuberculatum* Gabb. Length 112 mm.
Figs. 4, 5.—*Vasum dominicense* Gabb. Lengths 32 and 60 mm.
Fig. 6.—*Aclis alta* Gabb. Type.

Plate XXVIII.—Fig. 1.—*Murex rufus compactus* Gabb. Type. Length 56.4 mm.

- Figs. 2, 3.—*Trophon dominicensis* Gabb. Type. Length 17.5 mm.
Fig. 4.—*Murex textilis* Gabb. Type. Length 31 mm.
Figs. 5, 6.—*Typhis obesus* Gabb. Type. Length 24.8 mm.
Fig. 7.—*Muricidea striata* Gabb. Type. Length 12.3 mm.
Figs. 8, 9.—*Thais santodomingensis* Pils. & Johns. Type. Length 45 mm.
Fig. 10.—*Melongena antillarum* (Gabb). Young paratype. Length 43.7 mm.
Figs. 11, 12.—*Cymia henekenii tectiformis* n. subsp. Type. Length 46 mm.
Figs. 13, 14.—*Melongena orthacantha* Pils. & Johns. Type. Length 29.6 mm.
Figs. 15, 16.—*Melongena orthacantha* Pils. & Johns. Adult paratype. Length 36.4 mm.
Fig. 17.—*Melongena antillarum* Gabb. Type. Length 79 mm.

Plate XXIX.—Figs. 1, 9.—*Malea goliath* Pils. & Johns. Type. Length 129 mm.

- Fig. 2.—*Cymatium domingense* (Gabb). Type. Length 28.7 mm.
Fig. 3.—*Malea elliptica* Pils. & Johns. Type. Length 53.5 mm.
Fig. 4, 5.—*Bursa crassa proavus* Pils. Length 25 mm.
Figs. 6, 7.—*Potamides dentilabris* (Gabb). Length 49.6 mm.
Fig. 8.—*Bursa crassa bowdenensis* Pils. Length 48.7 mm.

- Fig. 9.—*Malea goliath* Pils. & Johns. Back of type.
 Figs. 10, 11.—*Potamides suprasulcatus* (Gabb). Lengths 29.5 and 20.5 mm.
 Fig. 12.—*Potamides prismaticus* (Gabb). Length 57.5 mm.

Plate XXX.—Figs. 1, 2, 3.—*Cypræa raymondobertsi* n. sp. Type. Length 27 mm.

- Fig. 4, 5.—*Cypræa spurcoides* Gabb. Type. Length 32.5 mm.
 Fig. 6.—*Cypræa raymondobertsi bowdenensis* n. subsp. Type. Length 25.5 mm.
 Figs. 7, 8.—*Cypræa dominicensis* Gabb. Type. Length 39 mm.
 Figs. 9, 10.—*Cypræa campbelliana* Pils. & Johns. Type. Length 30 mm.
 Figs. 11, 12.—*Capulus inornatus* Gabb. Type. Length 14 mm.
 Fig. 13.—*Orthaulax inornatus* Gabb. Young specimen 30 mm. long.
 Fig. 14.—*Orthaulax inornatus* Gabb. Largest specimen. Length 91.3 mm.
 Fig. 15.—*Orthaulax inornatus* Gabb. Type. Length 55 mm.
 Fig. 16.—*Orthaulax i. altilis* n. subsp. Young specimen 27 mm. long.
 Figs. 17, 18.—*Orthaulax i. altilis* n. subsp. Type. Length 52 mm.
 Figs. 19, 20.—*Hipponix otiosa* Pils. & Johns. Type and a small specimen; the upper left margin of the peristome broken in the former. Length 9.2 and 5 mm.

Plate XXXI.—Figs. 1, 2.—*Strombus galliformis* Pils. & Johns.

- Figs. 3, 4.—*Xenophora imperforata* Gabb. Type.
 Fig. 5.—*Melongena consors* (Sowb.). Dwarf form.

Plate XXXII.—Fig. 1.—*Strombus dominator* Pils. & Johns. Type.

- Figs. 2, 3.—*Cerithium microlineatum* Gabb. Type and paratype. Length 49 and 50 mm.
 Fig. 4.—*Cerithium venustum* Gabb. Type. Length 29 mm.
 Figs. 5, 6.—*Potamides gastrodon* Pils. & Johns. Type. Length 22.5 mm.
 Figs. 7, 8.—*Xenophora dilecta* Guppy. Diam. 51 and 56 mm.
 Fig. 9.—*Strombus dominator* Pils. & Johns. Type.

Plate XXXIII.—Figs. 1, 2.—*Cerithium turriculum* Gabb. Type.

- Figs. 3, 4.—*Cerithium dominicense* Gabb. Type.
 Figs. 5, 6.—*Cerithium obesum* Gabb. Type.
 Fig. 7.—*Cerithium simplex* Gabb. Type.
 Fig. 8.—*Cerithium turriculum* Gabb.
 Figs. 9-12.—*Cerithium obesum ventricosior* n. var. 10-12 are the type.
 Figs. 13, 17.—*Cerithium obesum gurabense* Maury. No. 4076.
 Figs. 14, 15.—*Cerithium obesum harrisi* n. var. Type.
 Figs. 16, 20.—*Cerithium uniseriale* Sowb. No. 2595.
 Fig. 17.—*Cerithium obesum gurabense* Maury.
 Figs. 18, 19.—*Cerithium obesum ventricosum* (?). No. 4075.
 Fig. 20.—*Cerithium uniseriale* Sowb. Enlarged view of No. 2595.

Plate XXXIV.—Fig. 1.—*Rissoina minuta* (Gabb). Type.

- Fig. 2.—*Bittium costatum* Gabb. Type. = *Rissoina bryerea* (Mont.), var. *binominis* Pils. & Johns.
 Figs. 3, 4.—*Eulima crassilabris* Gabb. Type (= *Rissoina laevigata* C. B. Ad.).
 Fig. 5.—*Rissoa epulata* Pils. & Johns. Type.
 Fig. 6.—*Rissoa proavita* Pils. & Johns. Type.
 Fig. 7.—*Epitonium amosbrowni* n. sp. Type.
 Figs. 8, 9.—*Epitonium santodomingense* n. sp. Type.
 Figs. 10, 11.—*Epitonium minutissimum* (Gabb). Type.
 Figs. 12, 13.—*Dolophanes melanoides* Gabb. Type. (= *Crepitacella*).
 Figs. 14 - 16.—*Hemisinus truncatus* (Gabb). Fig. 14, 36 mm. long.
 Fig. 17.—*Niso grandis* (Gabb). Type.
 Figs. 18, 19, 20.—*Torinia rotundata* Gabb.
 Fig. 21.—*Natica finitima* Pils. & Johns. Type.
 Fig. 22.—*Epitonium amplum* Gabb. Type. Diam. 13.5 mm.

Figs. 23, 24.—*Amauropsis burnsi meridionalis* n. subsp. Length 23.3 mm.
 Figs. 25-27.—*Amauropsis guppyi* (Gabb). Lengths 32, 28, 38 mm.

Plate XXXV.—Fig. 1.—*Mangilia dominicensis* (Gabb). Type.

Fig. 2.—*Alabina canaliculata* (Gabb). Type.
 Fig. 3.—*Alabina angustior* n. sp. Type.
 Fig. 4.—*Bittium asperoides* (Gabb). Type.
 Fig. 5.—*Aclis bartschiana* Pils. & Johns. Type.
 Fig. 6.—*Melanella gabbiana* Pils. & Johns. Type.
 Fig. 7.—*Melanella astuta* Pils. & Johns. Type.
 Fig. 8.—*Strombiformis ischnon* Pils. & Johns. Type.
 Fig. 9.—*Strombiformis sarissiformis* Pils. & Johns. Type.
 Fig. 10.—*Strombiformis praelubrica* Pils. & Johns. Type.
 Fig. 11.—*Alaba maoensis* (Gabb). Type.
 Fig. 12.—*Bittium yaquense* (Gabb). Type.
 Fig. 13.—*Pyramidella forulata famelica* Pils. & Johns. Type.
 Fig. 14.—*Pyramidella canaliculata* Gabb. Type.

Plate XXXVI.—Fig. 1.—*Turbonilla turriloides* Gabb. Type.

Fig. 2.—*Turbonilla beatula* Pils. & Johns. Type.
 Fig. 3.—*Turbonilla dominicensis* Gabb. Type.
 Fig. 4.—*Turbonilla santodomingensis* Pils. & Johns. Type.
 Fig. 5.—*Turbonilla galeata* Pils. & Johns. Type.
 Fig. 6.—*Turbonilla peræqua* Pils. & Johns. Type.
 Fig. 7.—*Turbonilla angustula* Pils. & Johns. Type.
 Fig. 8.—*Turbonilla aratibacillum* Pils. & Johns. Type.
 Fig. 9.—*Turbonilla insititia* Pils. & Johns. Type.
 Fig. 10.—*Turbonilla undecimcostata* Pils. & Johns. Type.
 Fig. 11.—*Turbonilla pertenuis* Gabb. Type.
 Fig. 12.—*Turbonilla contexta* Pils. & Johns. Type.
 Fig. 13.—*Turbonilla egressa* Pils. & Johns. Type.
 Fig. 14.—*Odostomia cyclocephala* Pils. & Johns. Type.
 Fig. 15.—*Odostomia bartschiana* Pils. & Johns. Type.
 Fig. 16.—*Odostomia mogindo* n. sp. Type.

Plate XXXVII.—Figs. 1, 1a, 1b.—*Teinostoma angulatum* (Gabb). Type.

Figs. 2, 2a, 2b.—*Teinostoma depressum* (Gabb). Type.
 Figs. 3, 3a, 3b.—*Teinostoma vitreum* (Gabb). Type.
 Figs. 4, 4a.—*Vitrinella amosbrowni* n. sp. Type.
 Figs. 5, 5a.—*Vitrinella naso* Pils. & Johns. Type.
 Fig. 6, 6a.—*Circulus domingensis* Pils. & Johns. Type.
 Fig. 7.—*Circulus domingensis* Pils. & Johns. Base of a more perfect specimen.

Plate XXXVIII.—Fig. 1, 1a.—*Leda extricata* Pils. & Johns. Type.

Fig. 2.—*Phacoides pupulus* Pils. & Johns. Type.
 Fig. 3.—*Phacoides perplexus* Pils. & Johns. Type.
 Fig. 4.—*Crassinella guppyi radiata* n. subsp. Type.
 Fig. 5.—*Nucula tuberculata* Gabb. Type.
 Fig. 6.—*Nucula tenuisculpta* Gabb. Type.
 Fig. 7.—*Crenella diuturna* Pils. & Johns. Type.
 Figs. 8, 9.—*Pandora inconspicua* Gabb. Type and paratype.
 Fig. 10.—*Cuspidaria gabbi* Pils. & Johns. Type.
 Fig. 11.—*Cuspidaria ornator* Pils. & Johns., variety.
 Fig. 12.—*Cuspidaria ornator* Pils. & Johns. Type.

Plate XXXIX.—Figs. 1, 2.—*Arca bonaczyi* (Gabb). Type.

Figs. 3, 4.—*Arca pennelli* Gabb. Type.
 Figs. 5, 6.—*Arca proletaria* Pils. & Johns. Type.
 Figs. 7, 8, 9.—*Arca intumulata* Pils. & Johns. Type and paratype.
 Fig. 10.—*Arca tolepeia saxeae* Pils. & Johns. Type.

- Figs. 11, 12.—*Arca tolepis crassicardinis* Pils. & Johns. Type.
 Figs. 13, 14.—*Arca tolepis scapularis* Pils. & Johns. Type.
 Figs. 15, 16.—*Arca cyclica* Pils. & Johns. Type.
 Figs. 17, 18, 19, 20. *Arca perfaceta* Pils. & Johns. Type and another specimen.

- Plate XL.—Fig. 1.—*Arca grandis* Brod. Santo Domingo. No. 2720.
 Figs. 2, 3.—*Arca chiriquiensis* Gabb. Chiriqui. Type and paratype.
 Figs. 4, 5, 6.—*Arca chiriquiensis* Gabb. Santo Domingo. No. 2722.

- Plate XLI.—Figs. 1, 2, 3.—*Arca chiriquiensis* Gabb. Chiriqui. No. 2724.
 Fig. 4.—*Arca c. websteri* Pils. Type.
 Figs. 5, 6.—*Arca dolaticosta* Pils. & Johns. Type.
 Fig. 7.—*Tellina errati* Pils. & Johns. Type.
 Fig. 8, 9.—*Arca deveza* Pils. & Johns. Type.

- Plate XLII.—Figs. 1, 2.—*Divaricella proletaria* Pils. & Johns. Type.
 Figs. 3, 10.—*Arca idiodon* Pils. Type. Wilmington, N. C.
 Figs. 4, 5, 6.—*Arca pomponiana* Pils. & Johns. Type and paratype.
 Figs. 7.—*Glycymeris approximans* Gabb. Type. Alt. 8.6 mm.
 Figs. 8, 9.—*Glycymeris diffidentia* Pils. & Johns. Type.
 Fig. 10.—*Arca idiodon* Pils. Type.
 Fig. 11.—*Glycymeris approximans* Gabb. Large specimen, alt. 21 mm.
 Figs. 12, 18.—*Glycymeris santodomingensis* Pils. & Johns. Type.
 Figs. 13, 14.—*Arca multilineata* Gabb. Type.
 Fig. 15.—*Turritella sulcigyrata* Pils. & Johns. Type.
 Figs. 16, 17. *Turbo dominicensis* Gabb. Type and paratype.
 Fig. 18.—*Glycymeris santodomingensis* Pils. & Johns. Type.

- Plate XLIII.—Fig. 1.—*Anomia gabbi* Pils. & Johns. Type.
 Figs. 2, 3.—*Ostrea bolus* Pils. & Johns. Type and paratype.
 Figs. 4, 5.—*Spondylus gumanomocon* Brown & Pils. Paratype and type.
 Fig. 6.—*Pteria inornata* (Gabb). Type.
 Fig. 7.—*Pteria inornata* (Gabb). No. 2641. An internal cast.
 Figs. 8, 9.—*Amusium papyraceum* (Gabb). Type and internal cast of another valve.

- Plate XLIV.—Figs. 1, 2.—*Pecten soror* (Gabb). Concave valve and detail of sculpture. Type.
 Figs. 3, 6.—*Pecten thetidis* Sowb. No. 2858.
 Figs. 4, 5.—*Pecten thetidis pelei* Pils. & Johns. Type.
 Figs. 7, 8, 9.—*Pecten ischnon* Pils. & Johns. Type and paratype.

- Plate XLV.—Figs. 1, 2.—*Pecten plurinominis* Pils. & Johns. Type.
 Fig. 3.—*Pecten interlineatus* Gabb. Type.
 Figs. 4, 5, 6.—*Pecten oxygonum* Sowb. No. 2867, with detail of basal margin.
 Figs. 7, 8.—*Pecten augusticostatus* Gabb. Type, with detail of basal edge of same.
 Fig. 9.—*Pecten uselmæ* Pils. & Johns. Type.
 Fig. 10.—*Venericardia aversa* Pils. & Johns. Type.
 Fig. 11.—*Pecten inaequalis* Sowb. No. 2847.
 Fig. 12.—*Pecten eccentricus* Gabb. Type.
 Fig. 13.—*Pecten correctus* Pils. & Johns. Type.
 Fig. 14.—*Venericardia scabricostata* Gabb. Type.

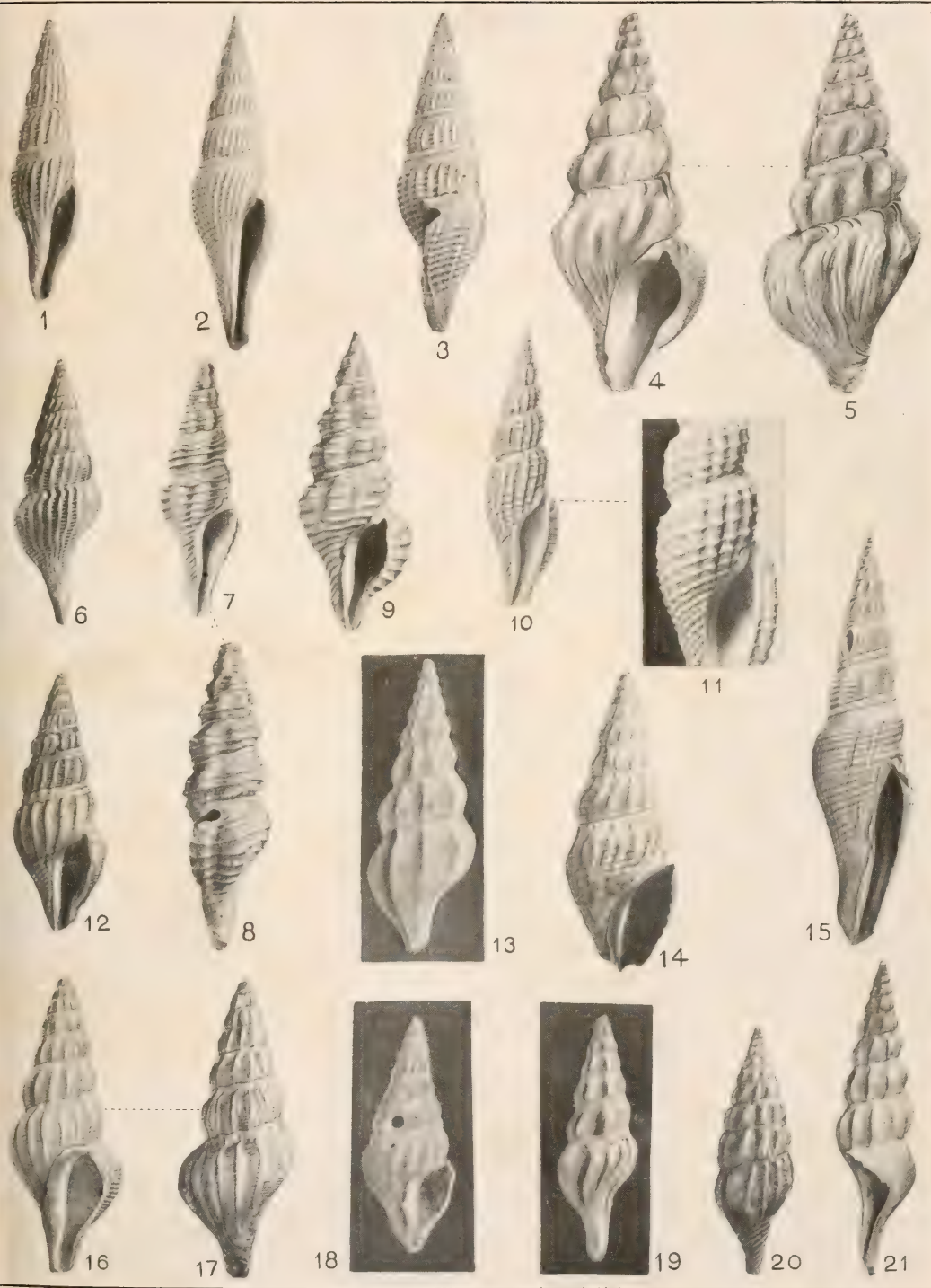
- PLATE XLVI.—Figs. 1, 2.—*Echinochama yaquensis trachyderma* Pils. & Johns. Type and paratype.
 Fig. 3.—*Lucina maurayæ* Pils. & Johns. Type.
 Figs. 4, 5.—*Metis efferta* Pils. & Johns. Type.
 Fig. 6.—*Lucina bulla* (Gabb). Type.
 Fig. 7.—*Metis chipolana* Dall. No. 2671.

- Fig. 8.—*Metis postrema* Pils. & Johns. Type.
Fig. 9.—*Semele delinata* Pils. & Johns. Type.
Fig. 10.—*Semele firma* Pils. & Johns. Type.
Fig. 11.—*Labiosa gabbi* Pils. & Johns. Type.
Figs. 12, 13.—*Corbula dominicensis* Gabb. Cotypes.
Fig. 14.—*Corbula knoxiana fossilis* Pils. & Johns. Type.

PLATE XLVII.—Fig. 1, 2.—*Chione santodomingensis* Pils. & Johns. Type.

- Figs. 3, 4, 5.—*Chione guppyana* Gabb. Type.
Figs. 6, 7.—*Chione primigenia* Pils. & Johns. Type.
Fig. 8.—*Cyclina cyclica domingensis* Pils. & Johns. Type.
Fig. 9.—*Dosinia azuana* Pils. & Johns. Type.
Fig. 10.—*Pitar acuticostatus* (Gabb). Type.
Fig. 11.—*Pitar tryonianus* (Gabb). Type.
Figs. 12, 13.—*Chione socia* Pils. & Johns. Type.

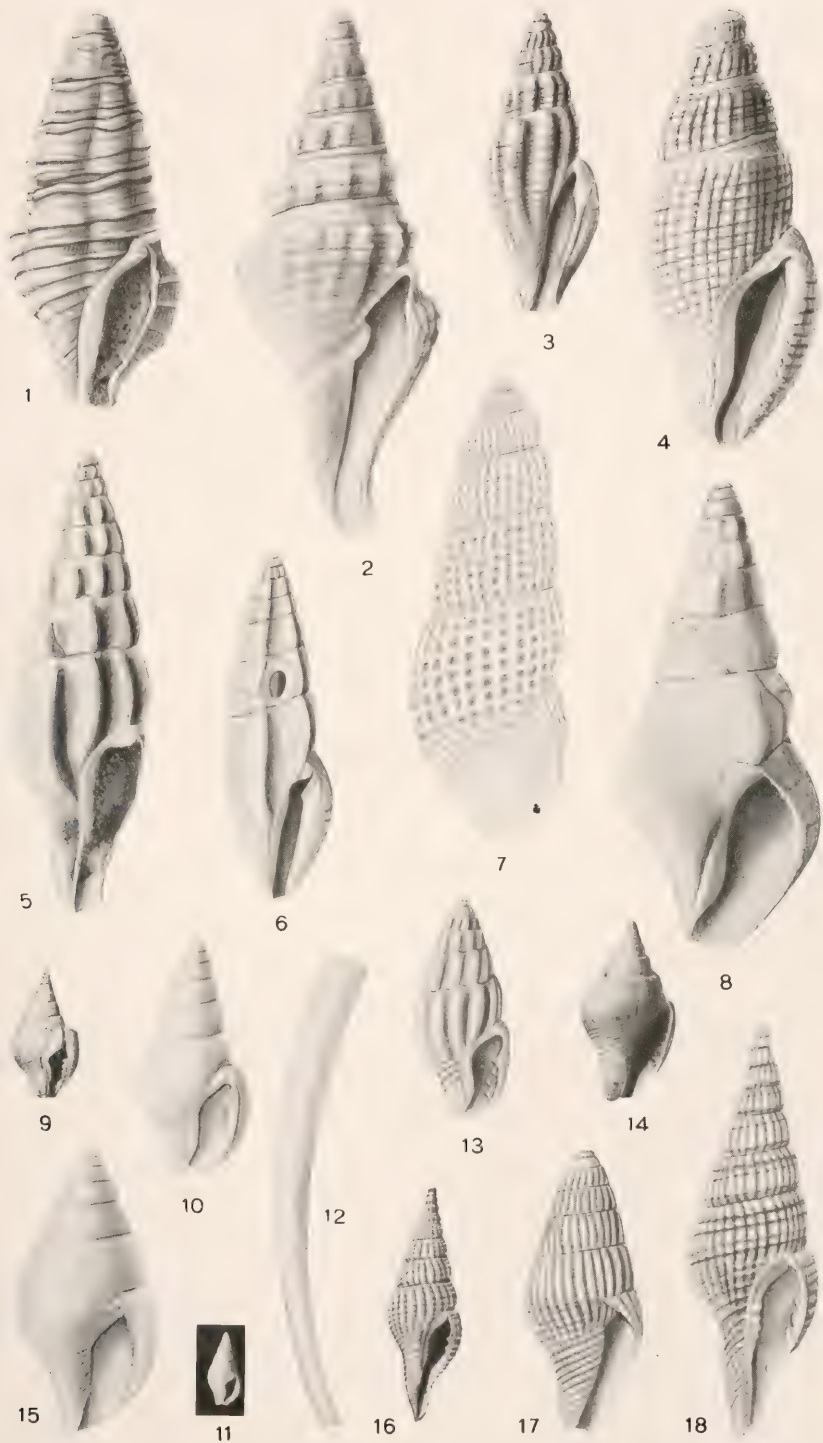
Figs. 8, 9 natural size, the others enlarged.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



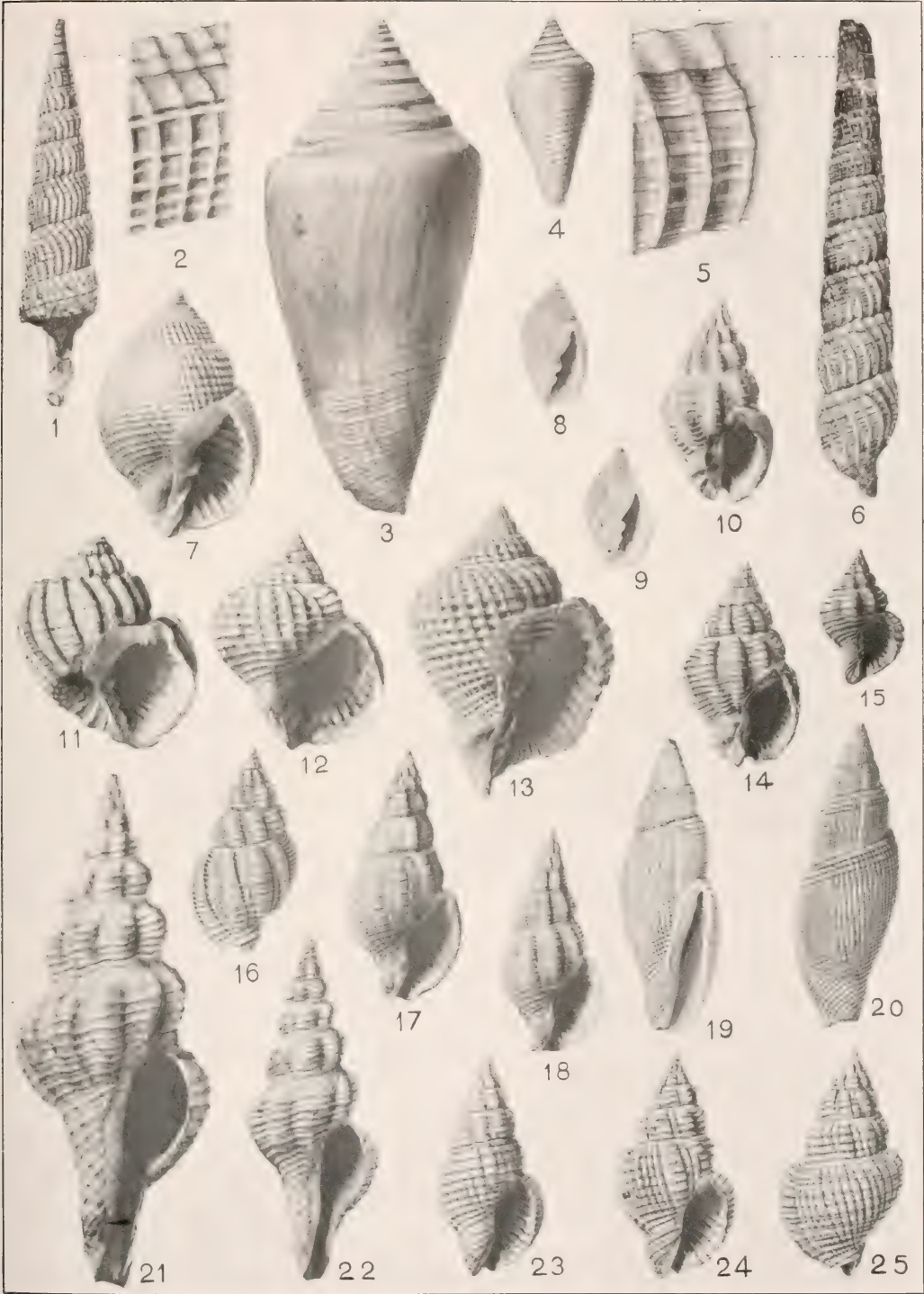
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



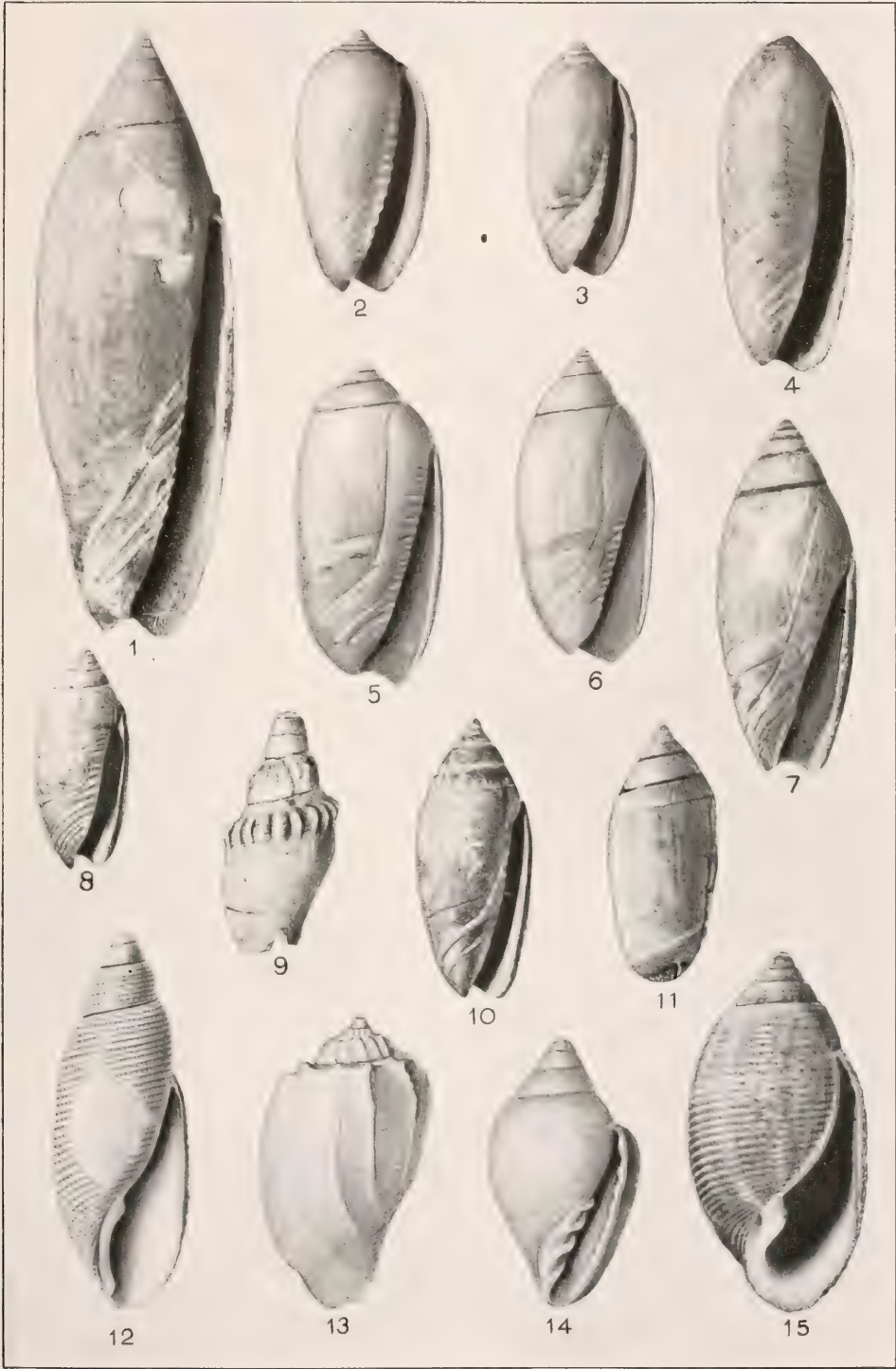
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



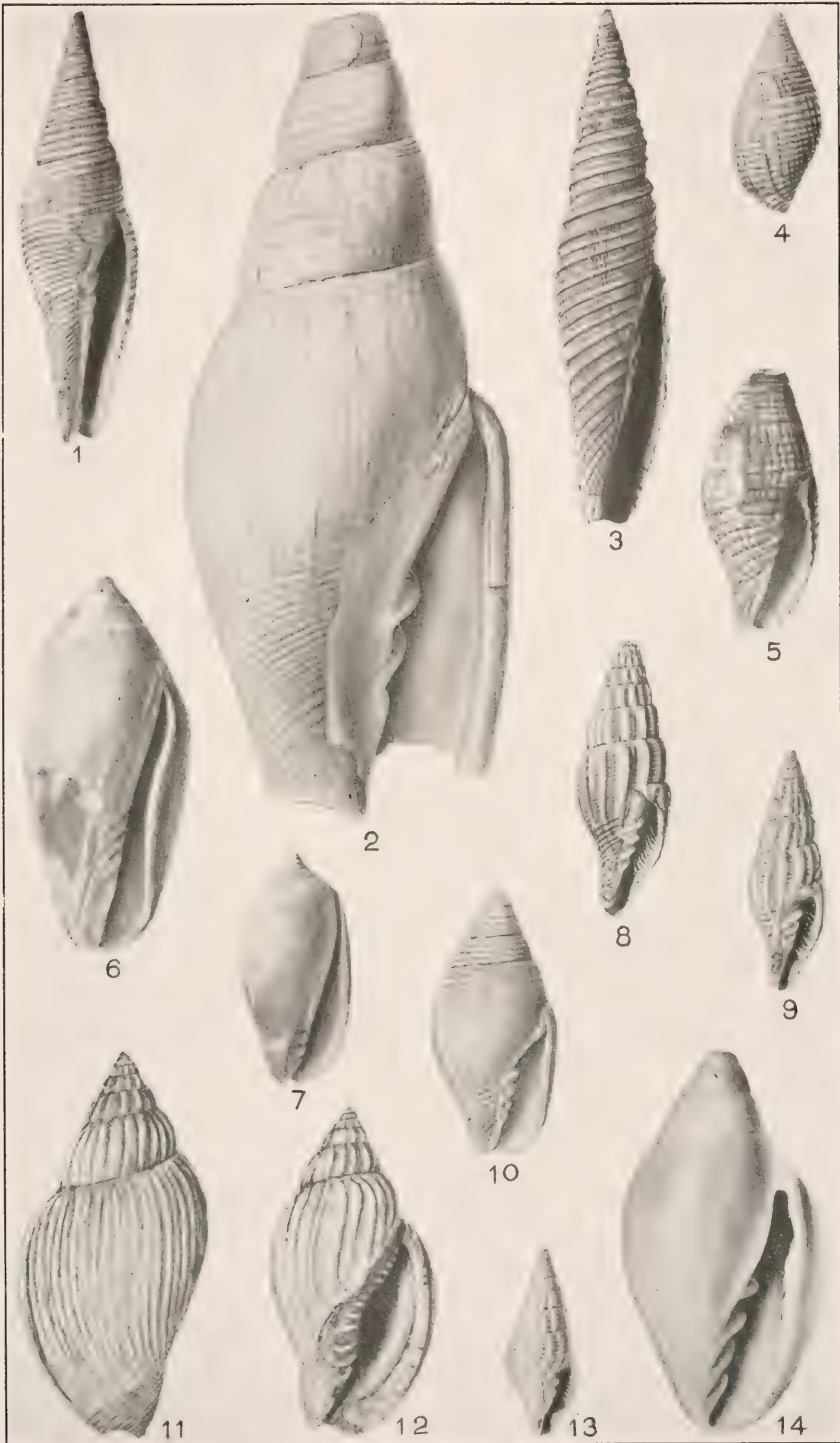
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



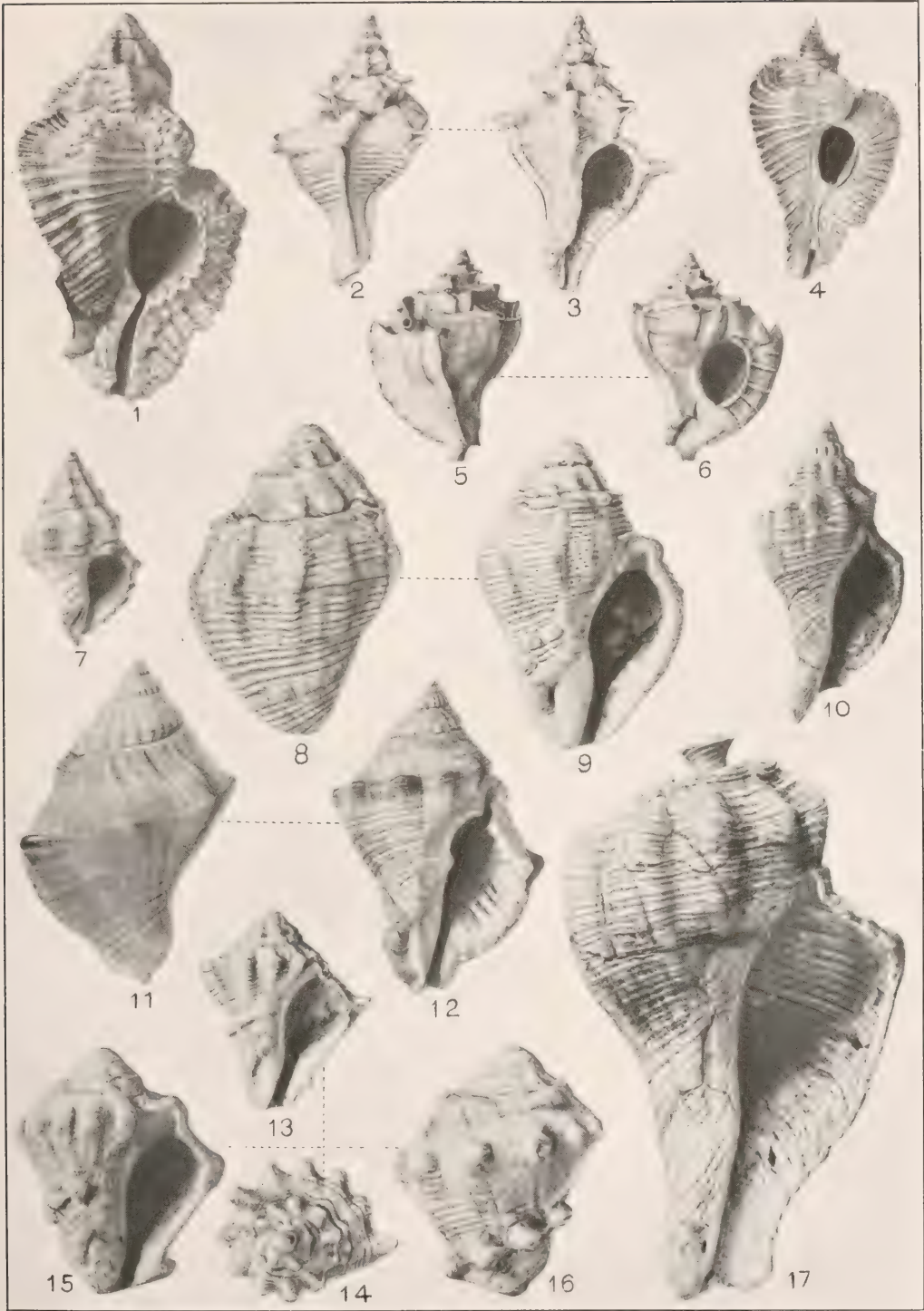
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



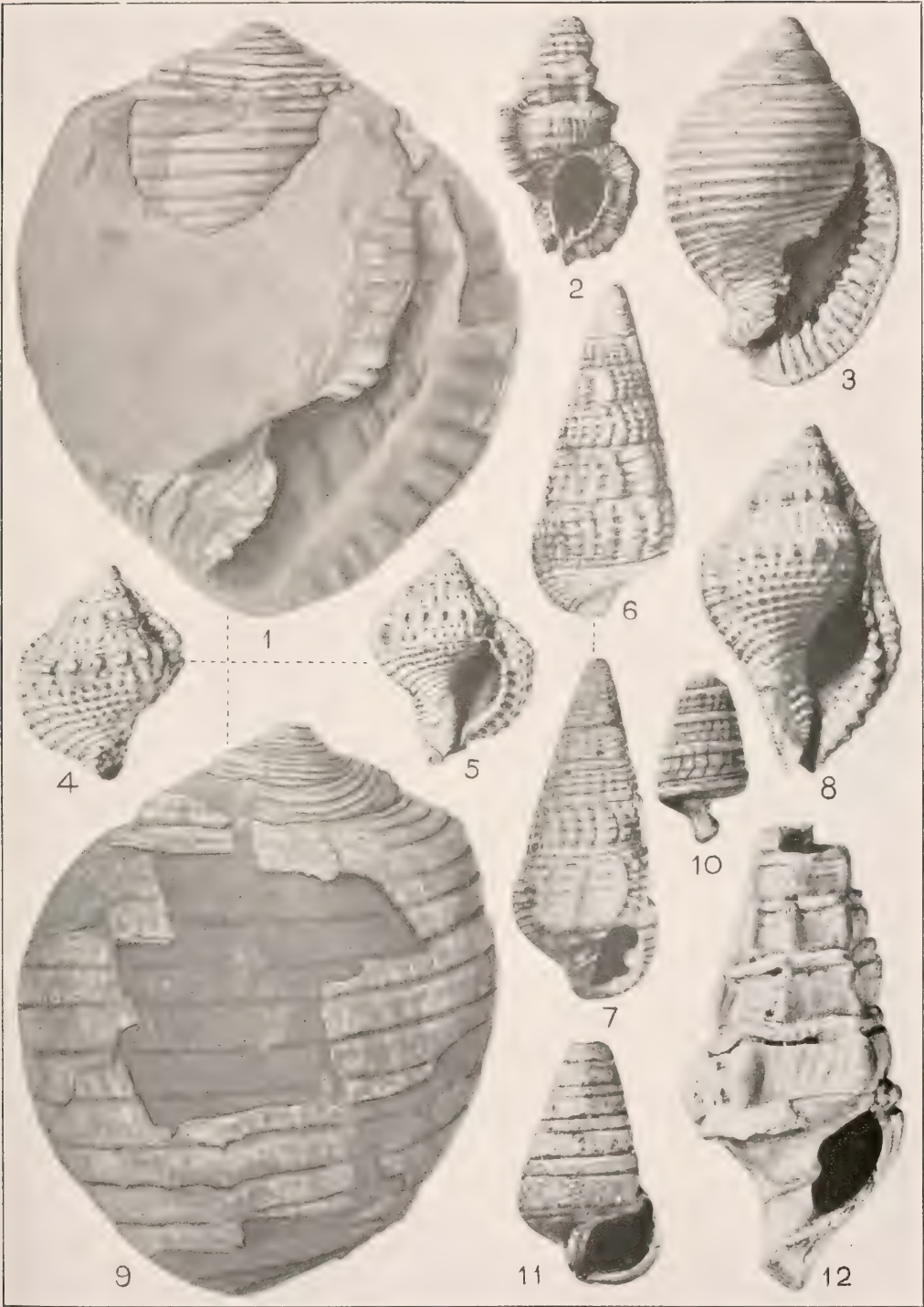
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



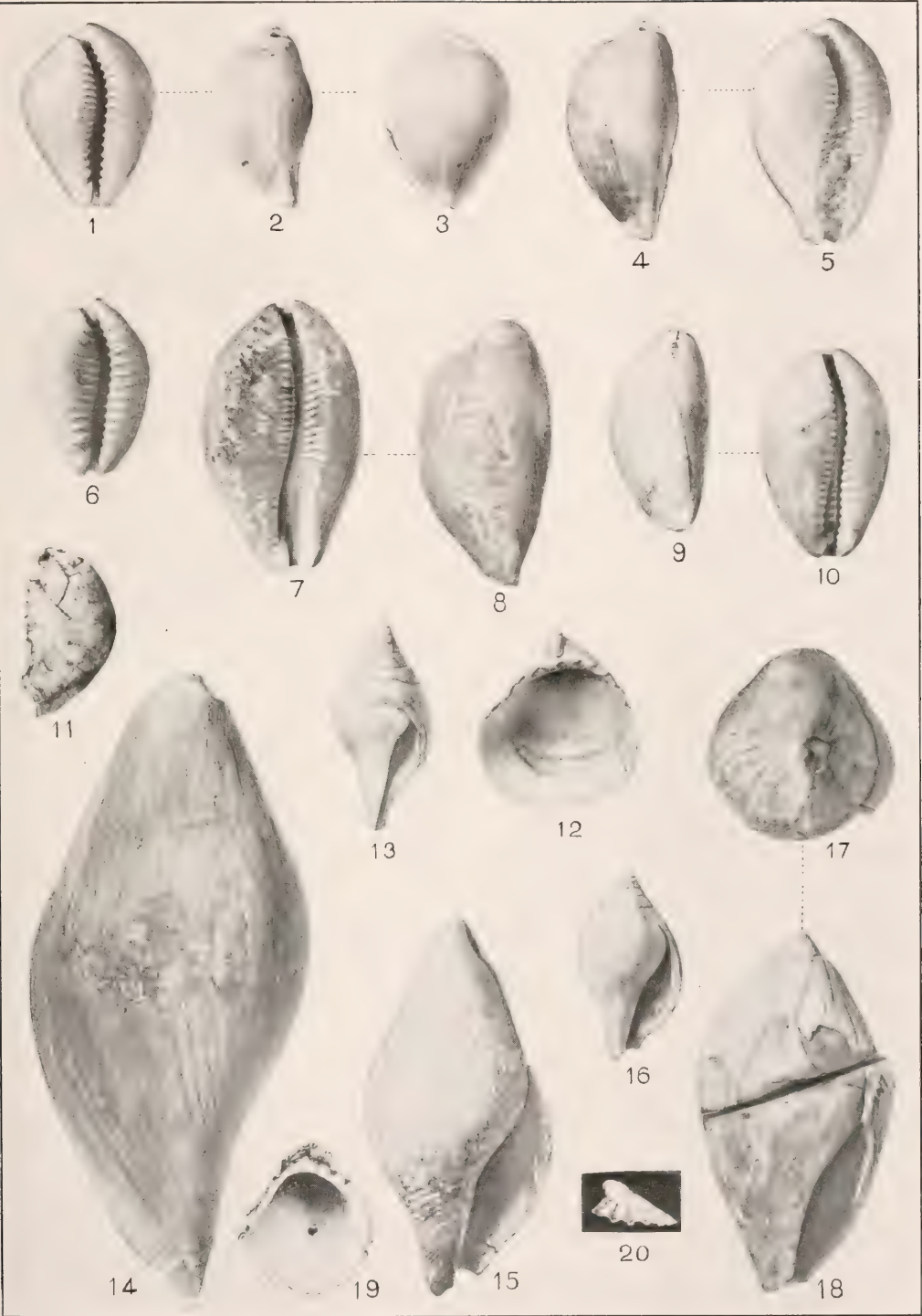
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOJ.LUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



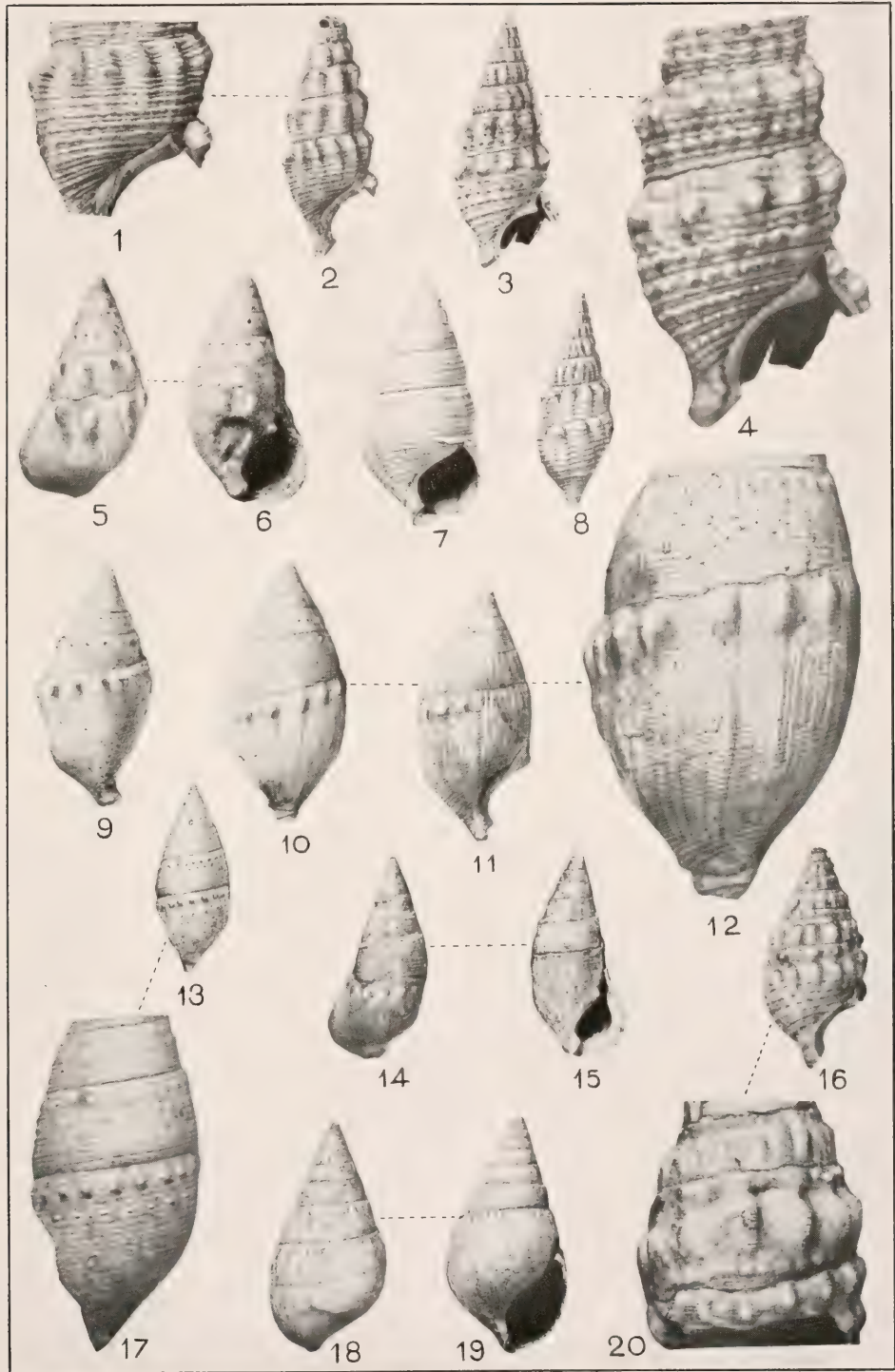
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



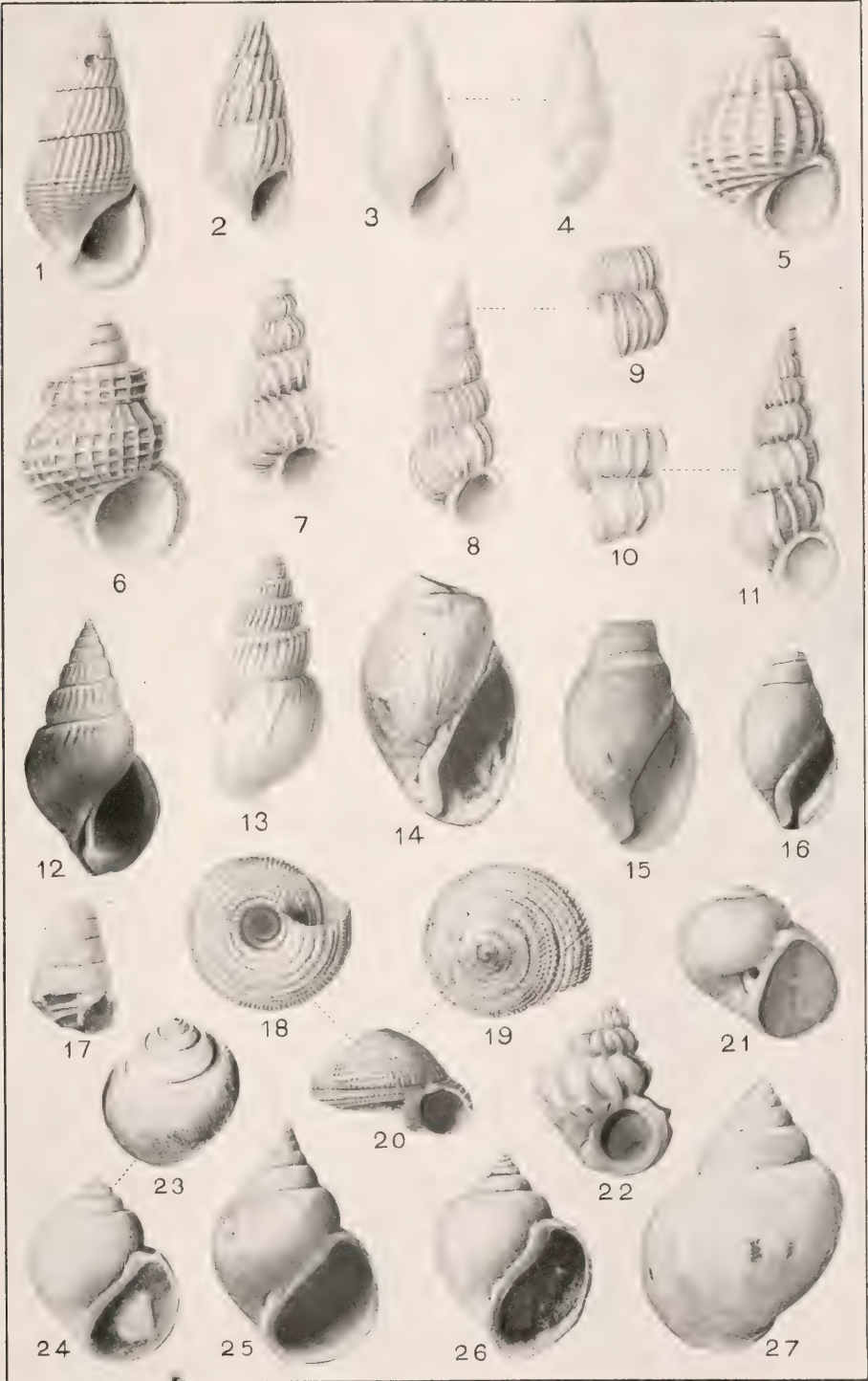
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



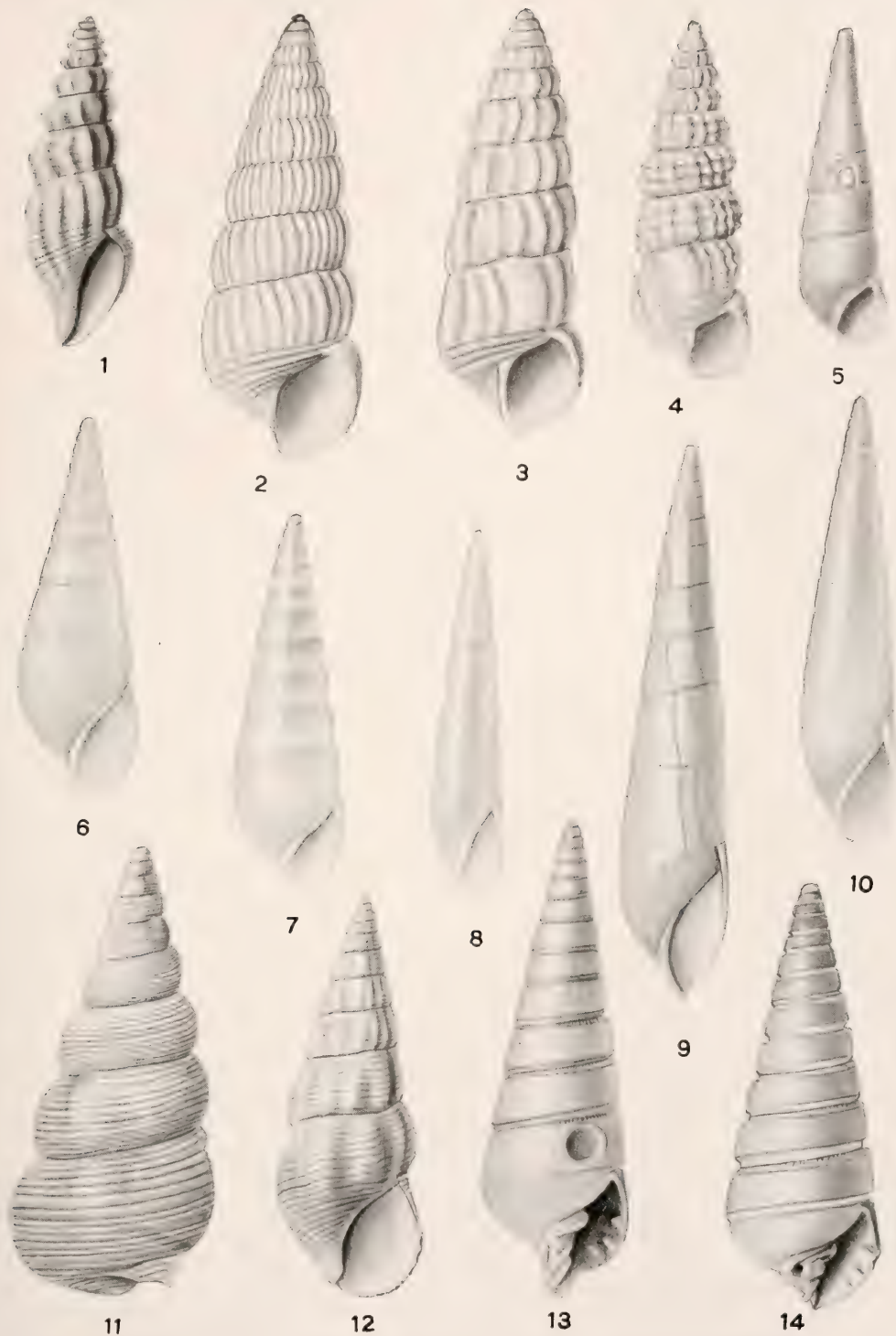
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



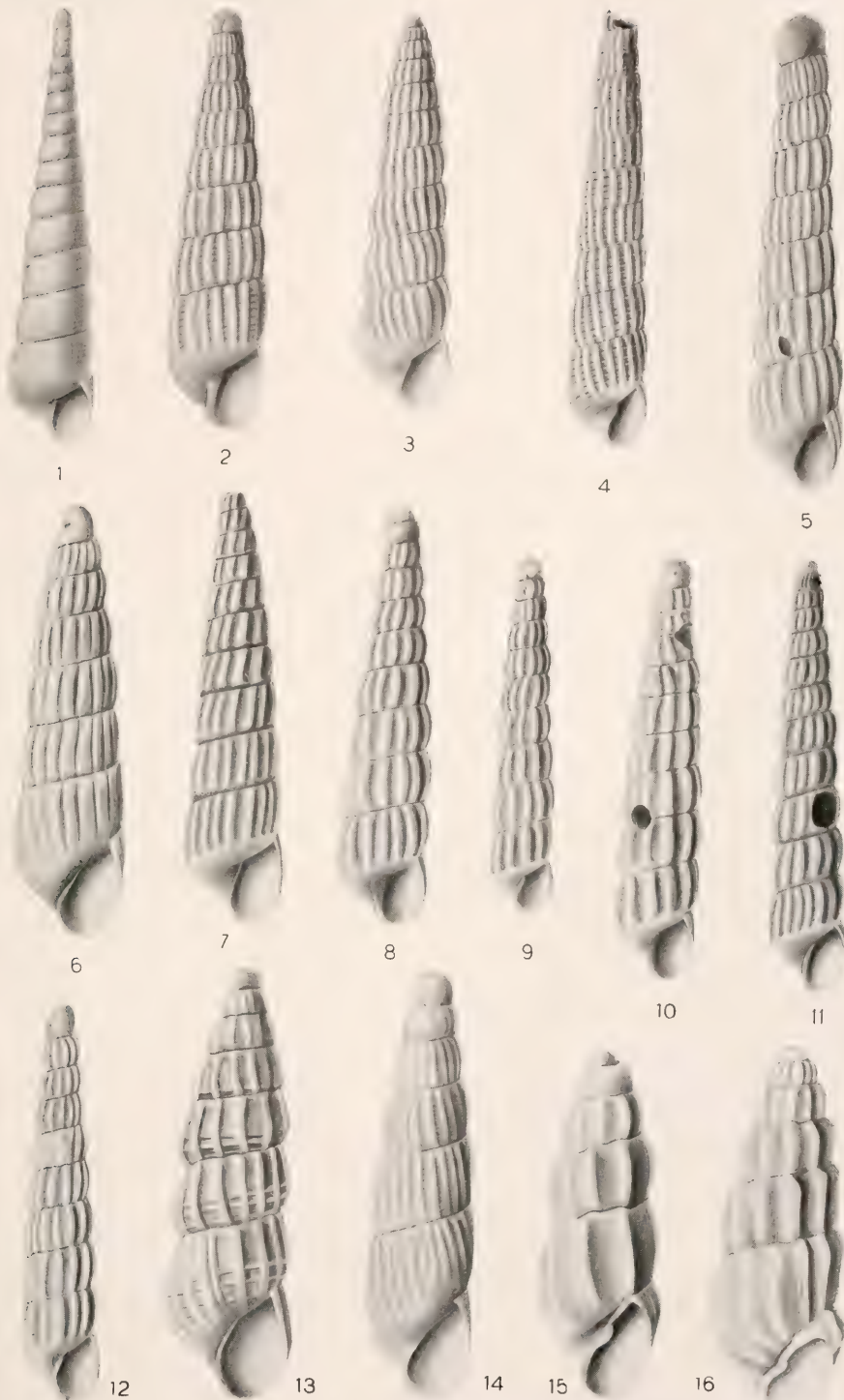
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.

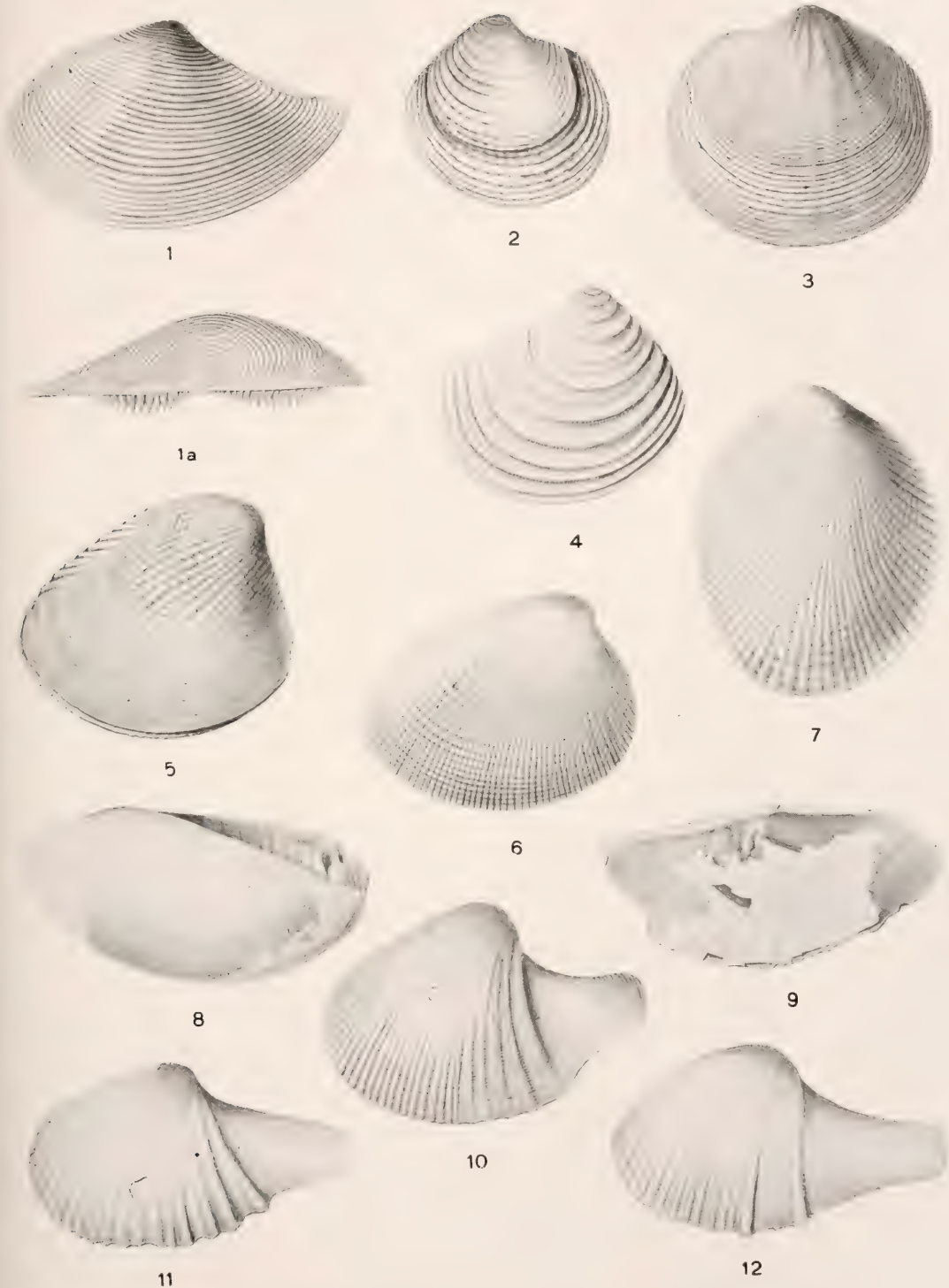


PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.

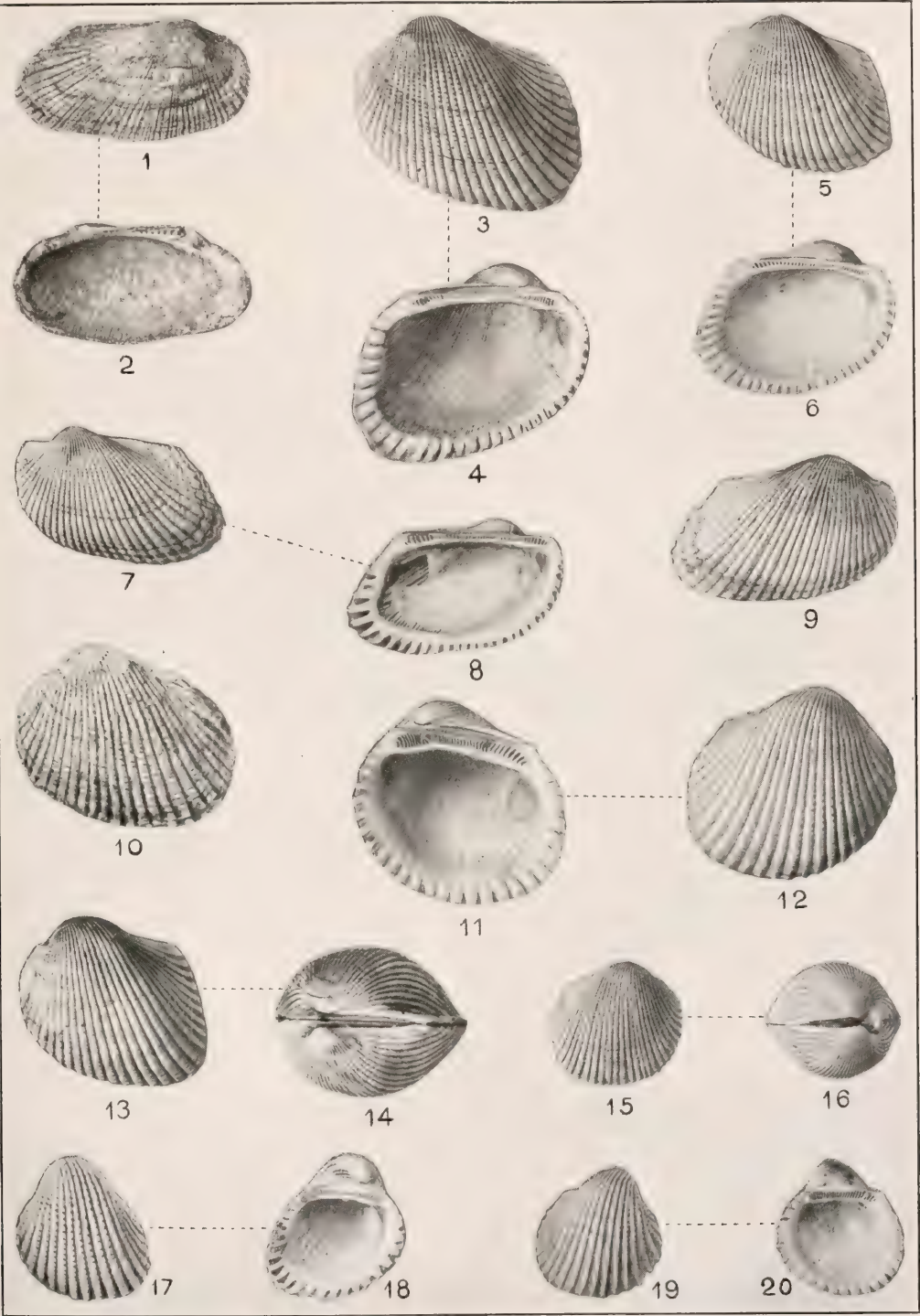


PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.





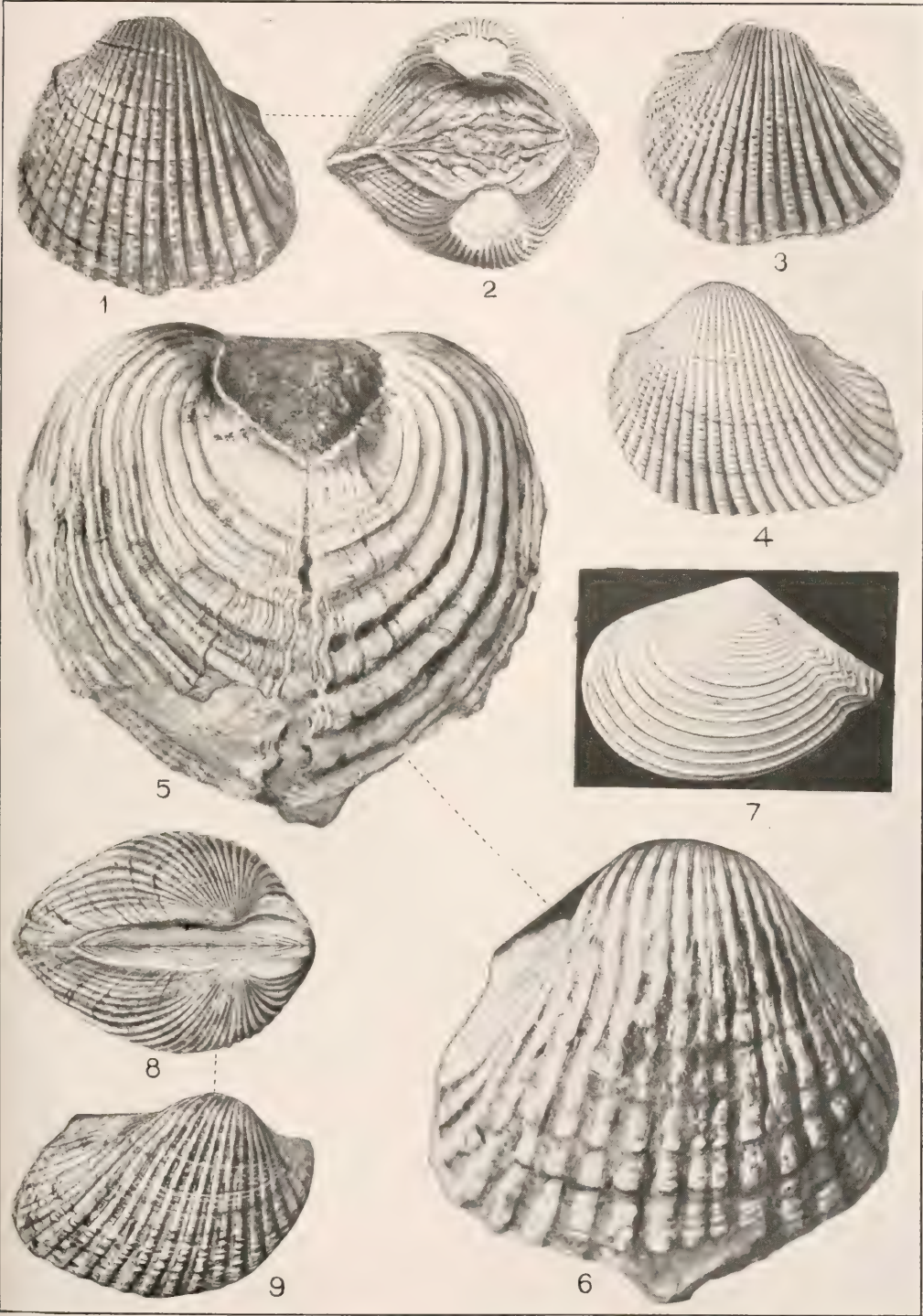
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



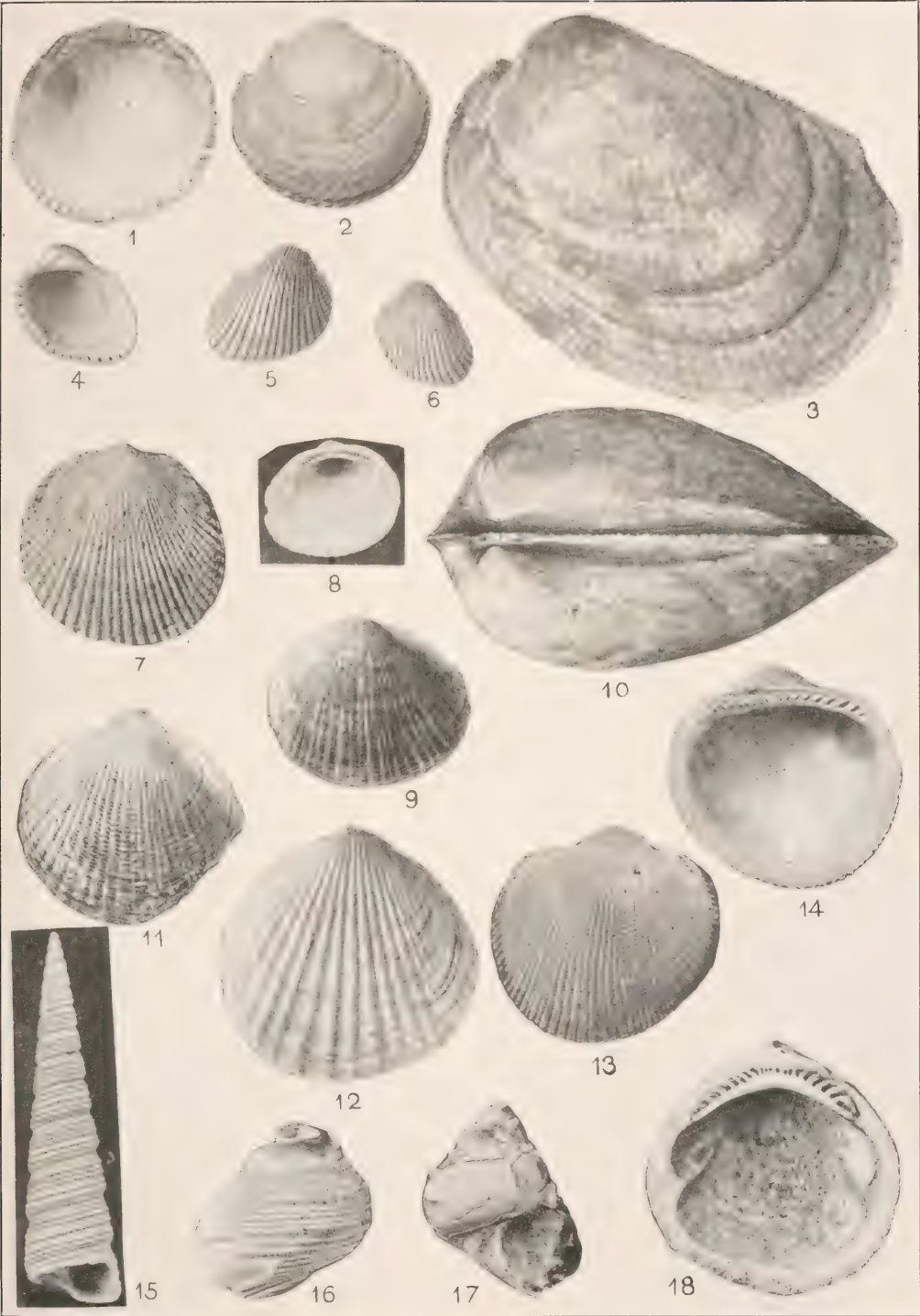
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



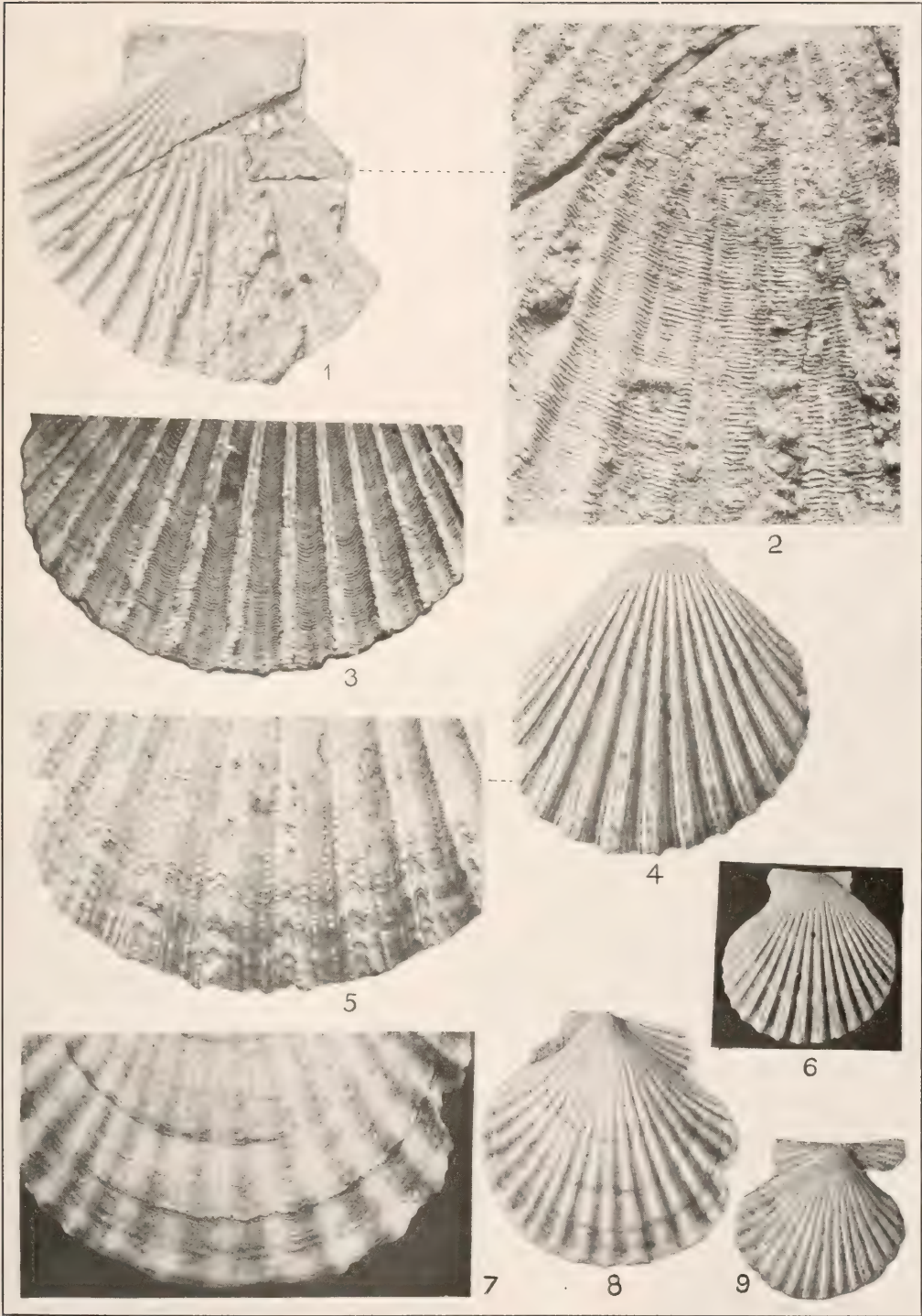
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



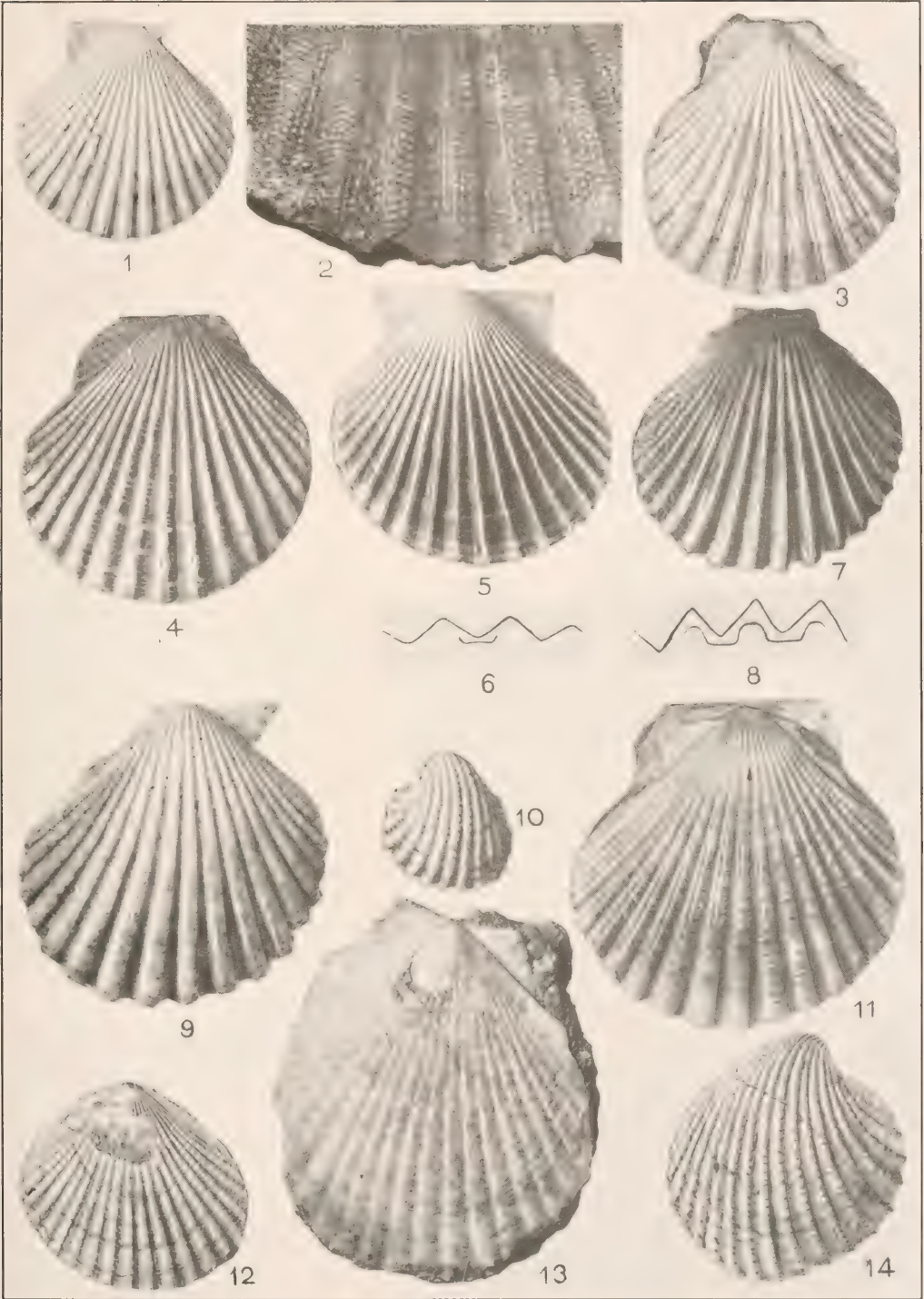
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



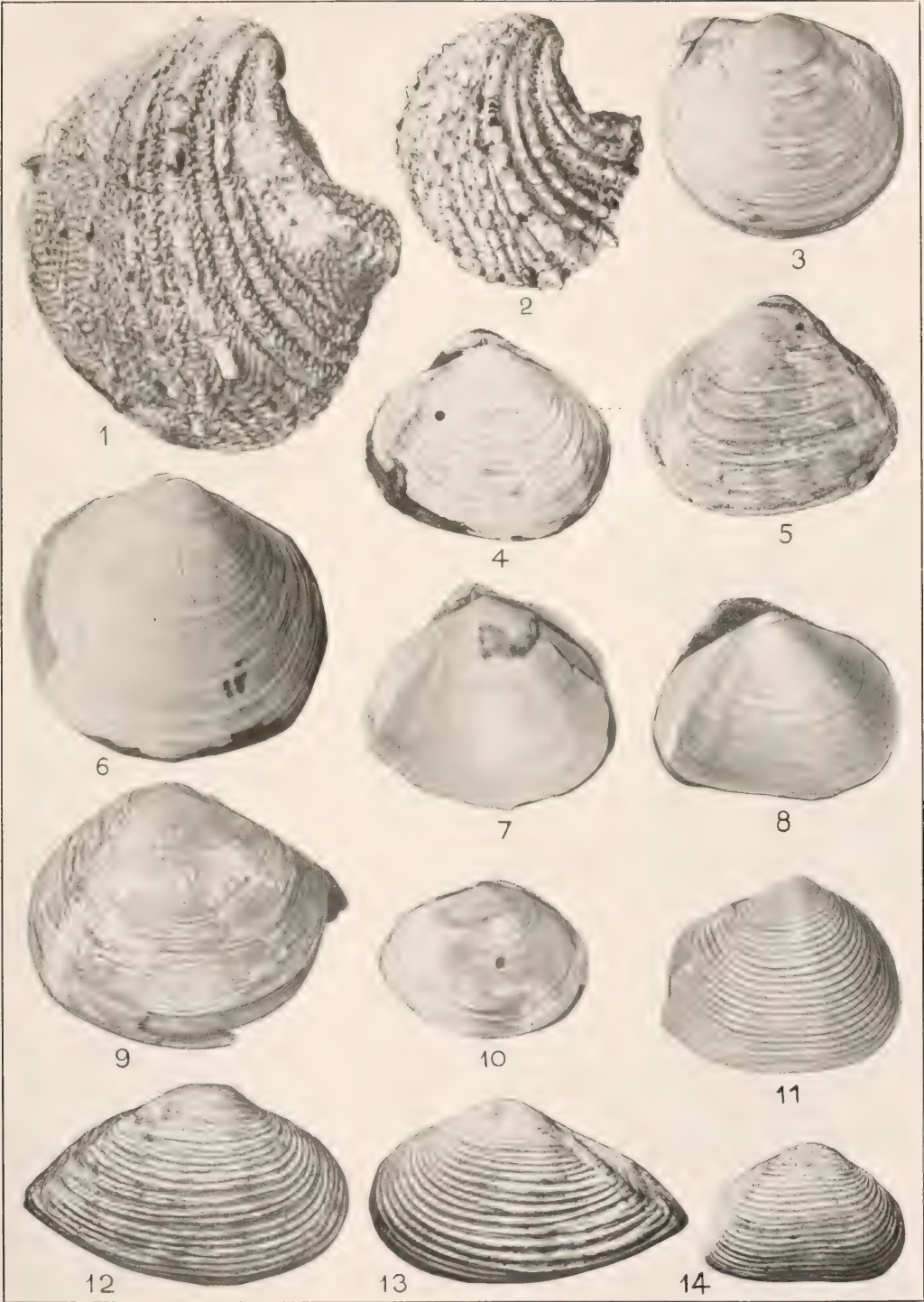
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



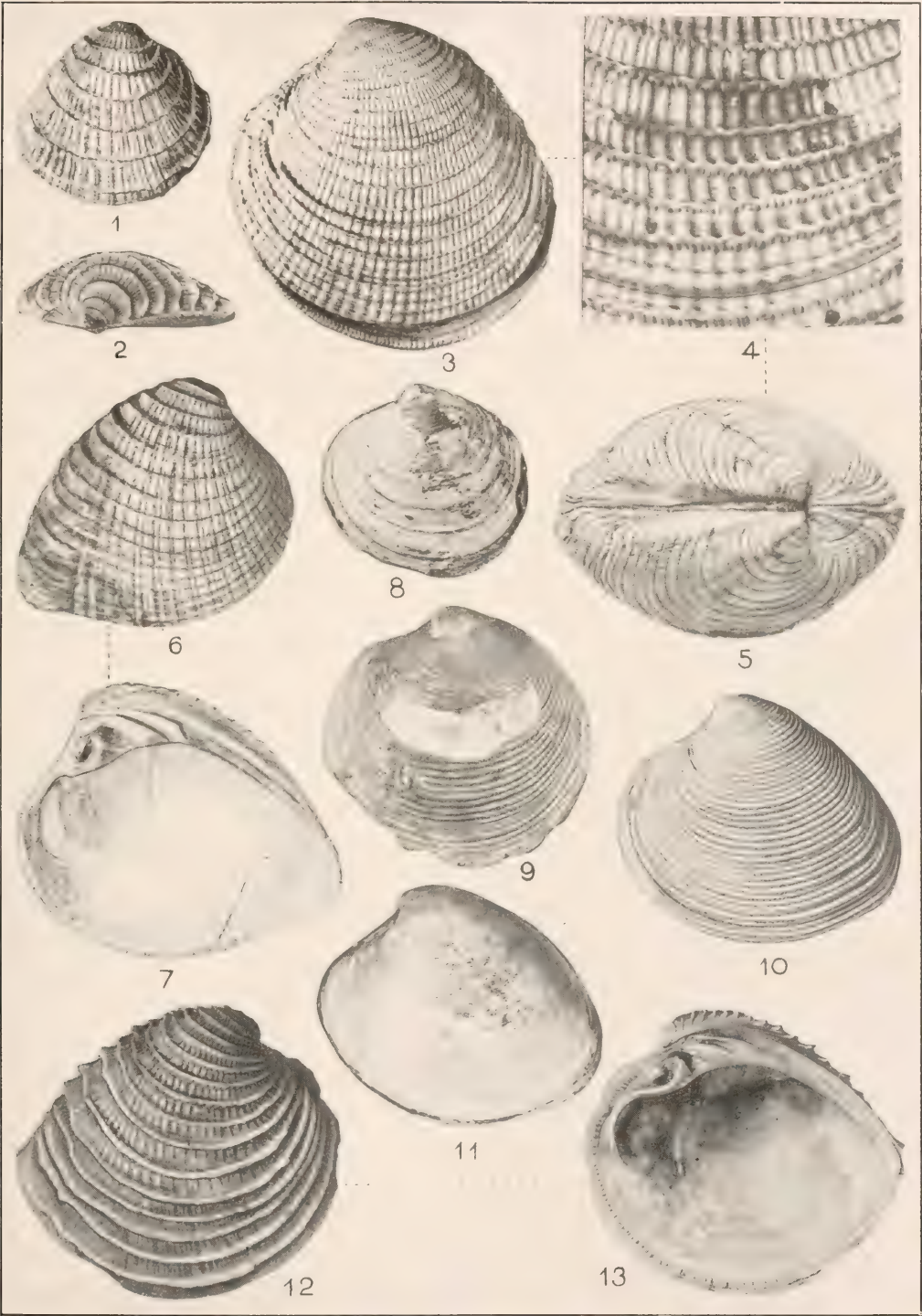
PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOLLUSCA OF SANTO DOMINGO.



PILSBRY: GABB'S TERTIARY MOJLUSCA OF SANTO DOMINGO.

NOTES ON HEMIBRANCHIATE AND LOPHOBANCHIATE FISHES.

BY HENRY W. FOWLER.

The fishes belonging to the above-named groups contained in the collection of the Academy are listed in this paper. Besides notes on variation, interesting records are given for some species for the first time, and two species are described as new.

GASTEROSTEIDAE.

Spinachia spinachia (Linné)

British Isles and Sweden.

Pungitius pungitius (Linné)

Europe, Sweden, Rostock in Germany, Magdalen Islands, Massachusetts, Salem, Rhode Island, Connecticut, New Jersey. My largest examples show: Head $3\frac{3}{4}$ to 4; depth $5\frac{3}{5}$ to 6; D. ix, often x, rarely xi, 9 or 10; A. i, 9, often 10; length 62 to 70 mm. In the entire series the dorsal shows mostly x, often ix, seldom or rarely viii or xi. In view of the great variation of these spines, even as low as ii have been given by some authors, it is not possible to use them as distinctive characters. The Japanese *Pygosteus steindachneri* Jordan and Snyder and *P. undecimalis* Jordan and Starks are nominal forms supposed to be distinguished chiefly according to their dorsal spines, and may therefore be merged in the synonymy. *Gasterosteus pungitius brachypoda* Bean has been placed as the Greenland representative, on the alleged character of its short ventral spine, which is a little less than half of the head. None of my examples shows the ventral spine more than half of the head, and most of them much less. In the young or small examples, these spines are quite short or small. It is therefore quite likely *Pungitius pungitius* is entirely circumpolar.

Gasterosteus aculeatus Linné.

Prince Edward Island, Magdalen Islands, Halifax, in Nova Scotia, Maine, Long Island, New Jersey, Virginia. Many from the Mediterranean, Lago Nemi and Italy as var. *brachycentrus*. This large series of all ages shows great variation, individual as well as geographical. It is impossible to clearly define the latter. All the

Mediterranean and Italian specimens are naked or partly armed. They show usually 4 plates, less frequently 0 to 5. In young examples from Prince Edward Island the armature is often incomplete, and the long ventral spines slender, frequently extending even $\frac{1}{3}$ beyond the pubic process or even twice length of the dorsal spines. All my Canadian examples have the armature less complete, or less in depth than in New Jersey specimens. This may, however, be due to age, as my largest ones are somewhat less than Long Island and New Jersey material. The Canadian specimens all agree with the Virginian examples, all of which are uniformly small. They have variously long or short spines. All show but a single ventral ray. The characters given by Jordan and Evermann for the nominal American forms¹ are entirely fallacious and my specimens violate all their alleged distinctions.

Gasterosteus aculeatus cataphractus (Pallas)

G. microcephalus Girard, Proc. Acad. Nat. Sci. Phila., 1854, p. 133. Four Creek, San Joaquin Valley, Cal.

Nos. 14,275 to 14,289, A. N. S. P., cotypes of *G. microcephalus* Girard. Others from San Francisco and Oakland, California; Puget Sound; Alaska. The distinctions given by Jordan and Evermann for this nominal form,—its robust form and longer spines, do not hold. A nearly equal variation is found in my Pacific specimens as in the Atlantic, and the present form is only admitted nominally.

Eucalia inconstans (Kirtland)

Gasterosteus micropus Cope, Proc. Acad. Nat. Sci. Phila., 1865, p. 81. Fort Riley, Kansas.

Nos. 14,184 and 14,185, A. N. S. P., cotypes of *G. micropus* Cope. Others from New York, Pennsylvania, Indiana, Iowa and Minnesota. They show D. v, rarely vi, usually 10, often 9, sometimes 8 and rarely 7 or 11; A. i, 9 or 10, rarely 7, 8 or 11; ventral spine $\frac{1}{2}$ to $1 + \frac{1}{3}$; length 24 to 65 mm.

Apeltes quadracus (Mitchill)

Prince Edward Island, Magdalen Islands, Maine, Rhode Island, Long Island, New York, New Jersey, Pennsylvania, Delaware, Maryland. This large series shows a wider range of variation than is usually credited to the dorsal spines. Seven examples have iii, 152 have iv, 283 have v, and 9 have vi. These spines are all very

¹ Bull. U. S. Nat. Mus., no. 47, pt. 1, 1896, p. 746.

variable in length, position and projection. In only one case were 2 closely situated spines found at the soft dorsal origin, the rays of the fin ranging 10 to 12. Only a single oval spine in all the examples, the rays 7 to 10. A young Delaware example shows unusually short or hardly developed innominate bones. The color pattern is also extremely variable, and in no two examples exactly alike.

Four examples Cope reported in 1865², labeled as having been brought from Sukertoppem, Greenland, by Dr. I. I. Hayes, are not *Eucalia inconstans*, with which he sought to identify them. I subsequently wrongly referred four examples, labeled "Godhavn, Disco Island, Davis Straits" from Dr. I. I. Hayes³ to *Gasterosteus aculeatus*, which suggests they may have changed labels.

AULOSTOMIDAE.

Aulostomus maculatus Valenciennes.

Two from Santa Cruz, W. I. Eye $2\frac{1}{5}$ to $2\frac{3}{5}$ in postorbital.

Aulostomus chinensis (Linné)

Honolulu, Hawaiian Islands, Oahu, Pacific Ocean. Eye $2\frac{1}{8}$ to $2\frac{2}{5}$ in postorbital.

FISTULARIIDAE.

Fistularia tabacaria Linné.

Manasquan, Ocean City, Beesley's Point, Angelsea, N. J.; Rio Janeiro, Brazil; Trinidad W. I.; Banda Point, West Africa. This material shows the variations quite extensively. The characters pointed out by Jordan and Starks in their distinctions for *F. petimba* and *F. depressa* are in some instances covered by my material. However the median ridges on the snout above are slightly divergent anteriorly. In all cases the skin is smooth.

Fistularia petimba Lacepede.

Hawaiian and Philippine Islands. I have not found any structural differences for this species, in attempting to distinguish it from the preceding. "Upper lateral edges of snout with few serrations or none" as given by Jordan and Evermann for their *F. tabacaria* in comparison with "upper lateral edges of snout sharply serrated" for *F. petimba*, are surely worthless. The blue spots for

² Proc. Acad. Nat. Sci. Phila., 1865, p. 81.

³ L. c., 1914, p. 365.

F. tabacaria are not found in any of my preserved specimens, either old or recent, apparently soon fading after death. My examples of *F. petimba* are smooth. All show the hind portion of the lateral line armed with firm plates, only less developed in the young, and in small examples some apparently affected by formaline. The same is true of *F. tabacaria*. The examples of *F. petimba* all agree in a slightly less deeply depressed interorbital, with narrower supraorbitals. Even some of the examples of *F. tabacaria* show a similar condition, and this is hardly a likely character for distinction.

MACRORHAMPHOSIDAE.

Macrorhamphosus scolopax (Linné)

Head $1\frac{4}{5}$ to $2\frac{1}{8}$; depth $3\frac{3}{4}$ to $4\frac{1}{2}$; snout $1\frac{3}{4}$ to $3\frac{2}{3}$ in head; eye $2\frac{1}{2}$ to $4\frac{1}{2}$ in snout; D. v or vi—11 or 12; A. 18 or 19. All show great variation in the length of the dorsal spine, as in some it does not depress much beyond the soft dorsal and in others it extends beyond the caudal tips. Its armature also quite variable, though usually distinct. In smaller or young examples obsolete or only few denticles. Young also have shorter snouts, deeper basally. Length 27 to 158 mm. Twenty-six from Italy.

Jordan and Starks state they have compared their *M. sagifue* with two specimens of the present species from the Canaries. They contend *M. sagifue* differs "in being a little more slender and in having a slightly smaller eye and longer snout." All these characters are, however, covered by my material, as the note above will show. Though they fail to note the length of their type it appears to measure according to their figure, about 115 mm. The correct distinctions therefore remain unknown for the nominal *M. sagifue*. None of my specimens appears to represent *M. gracilis* (Lowe) as described by Gunther. It is said to have the body depth $2\frac{3}{5}$ to 3 in space between opercle and caudal base, which is $1\frac{3}{4}$ to $2\frac{1}{2}$ in my specimens. A further distinction is the alleged weak armature of the dorsal spine.

Macrorhamphosus scolopax elevatus (Waite)

Head $2\frac{1}{10}$; depth $4\frac{1}{4}$, or $2\frac{1}{6}$ from gill-opening to caudal base; dorsal spine well armed, not depressible beyond soft dorsal. Victoria.

Centriscomps humerosus (Richardson)

One from Victoria, Australia, 110? mm. (caudal damaged).

CENTRISCIDAE.

Centriscus scutatus Linné.

One without data.

Centriscus strigatus (Günther)

One without data. *Aeoliscus* Jordan and Starks, based on this species, would appear only of sub-generic rank.

PEGASIDAE.

Parapegasus natans (Linné)

Padang, Sumatra.

SYNGNATHIDAE.

Entelurus aequoreus (Linné)

Osphyolax pellucidus Cope, Proc. Acad. Nat. Sci. Phila., 1875, p. 450, Pl. 25, figs. 1-4. Open Atlantic Ocean.

No. 860, A. N. S. P., type of *O. pellucidus* Cope. Duncker has correctly placed this nominal form as a synonym of *Syngnathus aequoreus* Linné⁴ and although the type has been overlooked until now, its identity is unquestioned. It is, however, still in good preservation and shows: Rings 29+62?; D. 37, on 8+3 rings; head $4\frac{3}{4}$ to vent; vent about opposite last third in dorsal base. Length 283 mm. On the basis of the very general type locality this species could hardly be included in the North American ichthyofauna.

Cope gives "thirty-one transverse rows of scuta" though my count shows the above formula. Also he says "dorsal radii sixteen," his figure showing 18, whereas there are actually 37. Also he gives "total length 23 m.," while his specimen is actually 283 mm. long.

Nerophis maculatus Rafinesque.

Rings 21 or 22+50 to 67; D. 21 to 25, on 2 or 3+5 rings. Three from Italy.

Gastrotokeus biaculeatus (Bloch)

Bacon and Philippines.

Doryrhamphinarum lineatum (Valenciennes)

Santo Domingo, W. I. Duncker sets aside *Doryrhamphinarum* Kaup⁵. Kaup included *Syngnathus heterosoma* Bleeker monotypically, and such is here acknowledged as its type. It therefore supersedes *Microphis* as used by Duncker.

⁴ Mitteil. Nat. Mus. Hamburg, 32, 1914 (1915), p. 32.

⁵ Cat. Lophobr. Fish, 185, p. 62.

Doryrhamphinarum brachyurum (Bleeker)

Rings 21 or 22+22 to 25; D. 38 to 43, on 1 or 2+7 or 8 rings. Eleven from Tahiti.

Corythoichthys fasciatus (Gray)

C. elerae Evermann and Seale, Bull. U. S. Bur. Fisher., 26, 1906 (1907), p. 57, fig. 2.

No. 33,252, A. N. S. P., paratype of *C. elerae* Evermann and Seale.

Corythoichthys conspicillatus (Jenyns)

Rings 16+40; D. 31 to 33, on 6 rings. Twelve from Tahiti.

Corythoichthys albirostris Kaup.

Rings 16+32; D. 28, on 4+5 rings. Marco, Lee County, Florida.

Micrognathus jonesi (Günther)

Rings 15 or 16+37 or 38; D. 25, on 1+3 or 4 rings. Three from Anclote Bay and three from Point Pinellos, west coast of Florida, both obtained by Prof. Angelo Heilprin in 1886. This species has not previously been recorded from the coast of the United States. These examples show fewer body rings and more caudal rings than the Porto Rican material reported by Evermann and Marsh.

Compared with *Syngnathus elucens* the present species differs in the median lateral ridge continuous with the lower caudal ridge, and the lower lateral trunk ridges end abruptly close before beginning of the lower lateral caudal ridge.

Syngnathus spicifer Rüppell.

Philippines. Rings 16+40; D. 26, on 7 body rings. This example agrees in most every respect with Rüppell's figure and description. It has upper right body and caudal keels continuous, though a little deflected below the dorsal base. Along this latter area an auxillary short superior parallel keel. As the color has faded the usual dark abdominal cross-bands are not evident.

Syngnathus matterni (Fowler)

Corythoichthys matterni Fowler, Proc. Acad. Nat. Sci. Phila., 1918, p. 11, fig. 5. Philippines.

Type, No. 47,484, A. N. S. P., of *C. matterni* Fowler. In the original account the misleading statement "this species differs from the preceding chiefly in its greatly elongated tail and shorter snout," refers to the specimen of *S. spicifer*, its reference having been deleted from my paper. Abdomen pale brownish, but with indistinct cross-bars.

Syngnathus elucens Poey.

Marquesas and Big Pine Keys, Florida. Rings 16 to 18+28 to 33; D. 28 to 30, in 3 or 4+4 or 5 rings. Length 55 to 117 mm.

Syngnathus schlegelii Kaup.

Yokohama and Otaru, Japan. Rings 19 or 20+40 to 43; D. 34 to 39, on 1+8 to 10 rings. Largest 229 mm.

Syngnathus californiensis Storer.

S. griseolineatus Ayres, Proc. Cal. Acad. Sci., 1854, p. 14. San Francisco Bay.

No. 835, A. N. S. P., type of *S. griseolineatus* Ayres. In very poor condition. Other examples from Monterey and California, and Willamette River, Oregon. Rings 19 to 21+42 to 52; D. 37 to 44, on 1+8 to 10 rings.

Jordan and Evermann say *S. griseolineatus* Ayres differs in a somewhat shorter snout, number of dorsal rays and rings, more keeled snout and dorsal covering 0 or 1+9 rings. My material all appears to be *S. californiensis* and the type of *S. griseolineatus* has at least 18 body rings and not one of the other specimens show less than 19.

Syngnathus pelagicus Linné.

Many examples; 5 labeled "Delaware Bay"; N. Lat. 24° 21' West Long. 34° 32'; N. Lat. 23° 20' West Long. 57° 29'; N. Lat. 23° 59' W. Long. 37° 59'; Lake George, Florida. Rings 16 or 17+29 to 32; D. 28 to 33, on 2 to 4+4 to 7 rings. All this material is characterized by the vertical white lines on the trunk, one on each ring inferiorly.

Jordan and Evermann place this species in their key under the group with "dorsal covering 4 or 5 body rings" and immediately below as "on 1+9 rings." In only one example (Lake George) have I found the dorsal on 4+4 rings. I cannot find *Siphostoma scovelli* Evermann and Kendall is distinct, and in fact its alleged distinctions are covered by the variations in my material.

Syngnathus fuscus (Storer)

Massachusetts, New Jersey, Delaware, Maryland and Virginia. Also one labeled "Neuse River, North Carolina." Rings 17 to 20+36 to 40; D. 32 to 40, on 4 to 6+4 to 6 rings. Largest 240 mm.

Syngnathus mackayi Swain and Meek.

Marquesas and Big Pine Keys, Florida. Rings 17 or 18+31 to 35; D. 29 to 31 on 1 to 3+5 to 7 rings. Largest 160 mm.

Syngnathus louisianae (Günther)

Marquesas and Big Pine Keys, Hailer's Rock, West Palm Beach and Pensacola, Florida. Rings 20 to 23+35 or 36; D. 33 or 34, on 3 or 4+4 to 6 rings. Largest 283? mm.

Syngnathus acus Linné.

Italy and Sweden. Rings 15 to 20+33 to 43; D. 33 to 39, on 1 to 3+6 to 9 rings. Largest 333 mm. In most upper lateral caudal keel continuous with median lateral keel of trunk.

Syngnathus pellegrini Fowler.

Proc. U. S. Nat. Mus., 56, 1919, p. 265, fig. 11. Gabun, West Africa.

Nos. 975 to 978, A. N. S. P., type and paratypes.

Typhlinus typhle (Linné)

Italy and Gulf of Spisia.

Stigmatophora argus (Richardson)

One from "Fiji" wrongly identified by me as *S. nigra* Kaup. Rings 19+48?; D. 42, on 8+6 rings. Likely this specimen is actually from Australia.

Leptonotus tristriatus n. sp. Fig. 1.

Head $2\frac{4}{5}$ to vent; depth 11; D. 42, on 3+8 rings, P. 12; rings 21+40? (tail damaged); snout about $1\frac{1}{2}$ in head; eye $2\frac{3}{4}$ in post-orbital region.

Body elongated, slender, well compressed, and apparently deepest midway in trunk, and combined head and trunk at least less than tail. Upper keels on each side of back extend back to seventh caudal ring. This replaced by similar parallel keel, beginning on last trunk ring and entirely continuous posteriorly. Median lateral keel from pectoral axis, and ends on last keel of trunk. Median belly keel complete from breast to vent. Lower keel along each side of body complete.

Head slender, attenuate, compressed, upper profile nearly straight. Snout greatly longer than rest of head. Eye rounded, small, though now little left but orbital rim, which at least $\frac{3}{5}$ of head depth at that point. Mouth small, terminal. Interorbital flat. Opercle without horizontal keel and fine striae radiating above and below.

Gill-opening?

Rings firm, and keels without spines. Each ring with numerous fine striae, vertical on plates.

Dorsal origin well before vent, fin small and rays rather short. Anal very small. Pectoral half length of postocular region.

Color in alcohol largely faded dull brownish. Back dull brown, with obscure paler dots or minute rounded spots. Dorsal pale brown. Brown band along side of snout to eye, and continued back over opercle and upper side of back, gradually merging in color of latter before dorsal. Median narrow streak of same color on upper surface of snout, continued over upper surface of head to predorsal, and much narrower than lateral head bands, or across interorbital about one-third its width. All these bands on head with margins darker or as if bordered with dusky-brown lines.

Length about 136 mm., measured to end of broken tail.

Type, No. 33,136, A. N. S. P. Fiji. Mrs. Agnes F. Kenyon.



Fig. 1.—*Leptonotus tristriatus* n. sp.

This species is related to *Leptonotus norae* Waite⁶ in the number of its rings and length of its snout. It differs, however, markedly in color-pattern. Originally I wrongly recorded this species as *Syngnathus semistriatus* (Kaup), a species which it appeared to resemble in structure, though it also differs strikingly in color-pattern.

(*Tri*, three; *stria*, stripe; for the color-pattern chiefly on the head.)

***Solenognathus guntheri* Duncker.**

Rings 25 or 26+56 or 57; D. 40? to 43? Two adults from Victoria, Australia, and two without data. They all agree with *S. hardwickii* Waite⁷, which has been named *S. guntheri* by Duncker.

***Phyllopteryx foliatus* (Shaw)**

Two males and 4 females from Portland, Victoria. *Syngnathus taeniloatus* Lacépède⁸ is synchronous with Shaw.

***Hippocampus hippocampus* (Linné)**

Italy and Port Mahon, Minôrca. D. 16 to 19, on 3+1 rings; rings 12+35 or 36. Also a number of dried examples without data.

***Hippocampus hudsonius* De Kay.**

Rhode Island, New Jersey, Delaware. D. 17 to 20, on 3 or 4+1

⁶ Records Canterbury Mus., I, No. 3, 1911, p. 173, Pl. 27, fig. 1.

⁷ Proc. Linn. Soc. N. S. Wales, (2) 9, 1894, p. 221, Pl. 17, figs. 2-4, 7.

⁸ Ann. Mus. Hist. Nat. Paris, 4, 1804, p. 211, Pl. 58, fig. 3.

rings; rings 11 to 13 + 34 to 38. This species is very close to the preceding, and may not eventually prove to be distinct. The specimens fail to show any tangible structural characters and the variations are in most every way conformable. Both have a similar general style of coloration, even to the dark median ventral keel and submarginal dark band on the dorsal. The female likewise shows the vent in a dark area.

Hippocampus punctulatus Guichenot.

Bermuda; Vera Cruz, Mexico; Port of Silam, Yucatan; Bahamas; Santa Cruz, W. I.; Key West, Marquesas Keys and Useppa Island, Florida; Maldonado Bay, Uruguay; São Thome, Portuguese Guinea. The Useppa Island example agrees in most every respect with the nominal color variety *H. brunneus* Bean⁹. Possibly *H. stylifer* Jordan and Gilbert is another variation, though none of my examples shows so few as 16 D. rays.

Hippocampus sindonis Jordan and Snyder.

A dried example labeled "coast of Japan," from Dr. W. N. Whitney, conspicuous for its extremely high bony occipital crest.

Hippocampus ingens Girard.

Two in bad preservation, from Panama.

Hippocampus zosterae Jordan and Gilbert.

Marquesas Keys, Florida.

Hippocampus kuda Bleeker.

H. taeniops Fowler, Journ. Acad. Nat. Sci. Phila., (2) 12, 1904, p. 501, Pl. 7 (upper left fig.). Padang, Sumatra.

No. 27,469, A. N. S. P., type of *H. taeniops* Fowler.

Hippocampus abdominalis Lesson.

H. bleekeri Fowler, Proc. Acad. Nat. Sci. Phila., 1907, p. 426, fig. 4. Victoria, Australia.

H. agnesae Fowler, l. c., 429, fig. 5. Victoria.

No. 33,122, A. N. S. P., type of *H. bleekeri* Fowler.

No. 33,123, A. N. S. P., type of *H. agnesae* Fowler.

Hippocampus ecuadorensis n. sp. Fig. 2.

Head, measured to gill opening, $1\frac{1}{4}$ in trunk; depth of trunk 2 in its length; width of trunk about 4; trunk $2\frac{1}{4}$ in tail; D. 22; A. 5; P. 16; rings 11 + 36; depth of head at coronet $1\frac{3}{4}$ in its length; width of head $3\frac{1}{2}$; snout $2\frac{1}{5}$; eye $6\frac{1}{3}$; dorsal base $2\frac{1}{3}$; interorbital space $1\frac{1}{2}$ in eye.

⁹ Field Mus. Pub. Zool., 7, July 1906, p. 39, fig. 1. Bermuda.

Body long, moderately deep, trunk short and well compressed. Trunk long, slender, slightly compressed.

Head moderately large, compressed. Snout slightly attenuated, wide as deep basally. Eye moderate, midway in head length. Mouth terminal, broad, superior, and closed lower jaw slightly in-

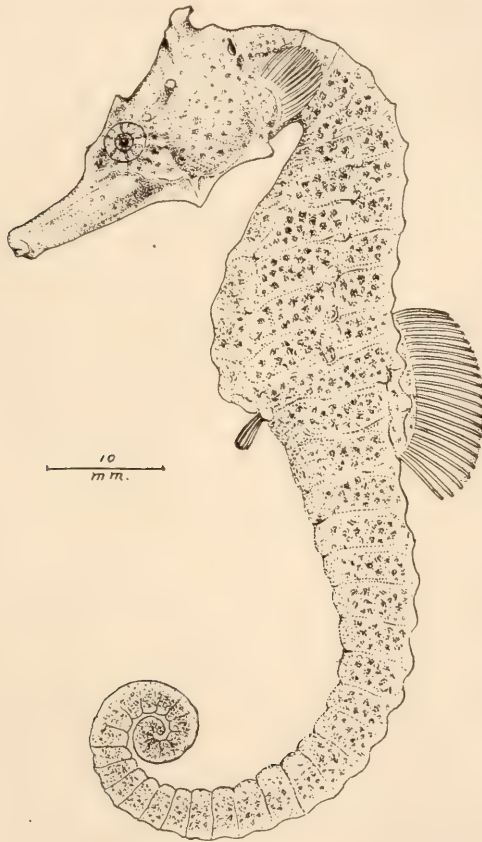


FIG. 2.—*Hippocampus ecuadorensis* n. sp.

cluded. Nostrils small, close together and close before front rim of orbit. Interorbital narrow, triangular, concave.

Gill-opening about half of eye, inclined in vertical, laterally superior on nape.

Coronet moderately elevated, with two lateral ridges and median

posterior ridge. Below and slightly in advance, a strong spine directed laterally. Slight median ridge above nostrils. Supraocular spine broad and directed laterally. Very small postorbital tubercle, close behind eye. Shoulder-girdle with three moderately large tubercles. Opercle with rather obsolete radiating striae. Body-rings with edges as ridges, without spines, though at some junctures slight tubercles. Ridges on tail-rings more or less obsolete.

Fins moderate, rays simple. Dorsal base moderate, on 2 body and 2 caudal rings. Anal long as eye. Pectoral base broad, fin little longer than eye. Vent close before anal.

Color in alcohol dull brown. Body marked with numerous small round obscure spots of dull brown. Also many pale or whitish dots sprinkled about irregularly, often as short lines or specks. Dorsal and pectoral, pale, uniform or unmarked.

Length, from tip of coronet to tip of extended tail, 145 mm.

Type, No. 24,198, A. N. S. P. Bahia, Ecuador. September, 1884. Dr. W. H. Jones.

Differs from *H. ingens* Girard in more dorsal rays, larger eye, blunt body and tail rings, and the absence of dermal flaps.

(Named for Ecuador.)

THE CHROMITE DEPOSITS OF THE STATE LINE SERPENTINES.¹

BY SAMUEL G. GORDON.

The chromite deposits described below occur in a belt of serpentine situated on the Pennsylvania-Maryland line, in Lancaster and Chester counties, Pennsylvania, and Cecil County, Maryland. In the last century the district was an important producer of chromite, and during the recent war attempts were made to reopen the mines, but with little success. Aside from economic considerations, the deposits are of considerable scientific interest, as the data regarding chromite deposits are rather meager, beyond the fact that they appear to be true magmatic segregations without the aid of "mineralizers."

GENERAL GEOLOGY.

The geology of the district has been described by Rogers², Chester³, Frazer⁴, and Bascom⁵. The serpentines of the belt represent hydrothermal-metamorphosed peridotites and pyroxenites, part of an igneous complex forming a large batholithic mass overlain on the north by mica gneisses. The following interesting petrographic succession is exhibited in passing northwestward across the batholith-biotite-grandiorite, hornblende-biotite-granodiorite, quartz-biotite-hornblende-gabbro, quartz-hornblende-gabbro, hornblende-norite and quartz-norite, norite, pyroxenite, and peridotite. The main types are considered by F. Bascom to represent differentiation of the magma before intrusion, while their gradations are thought to represent subsequent differentiation.

¹ The writer is indebted to Dr. Edgar T. Wherry for a critical review of the manuscript, and to Mr. F. Lynwood Garrison for various courtesies extended to him during his visit to the district in April and August, 1920. The albitites were described in a previous article in these proceedings, and an account of the minerals of the district will appear in *The American Mineralogist*.

² Henry D. Rogers, *Geology of Pennsylvania*, 1858.

³ Frederick D. Chester, *Ann. Rep. Second Geol. Surv. Penna.* 1887, 93-105, 1889.

⁴ Persifer Frazer, Jr., *Second Geol. Surv. Penna. Reports C3 and C4*, 1880 and 1883, *Geology of Lancaster County and Chester County*.

⁵ F. Bascom, *Cecil County; Maryland Geol. Surv.* 1902, 83-148.

CHROMITE DEPOSITS.

The chromite deposits occur exclusively in the meta-pyroxenite and meta-peridotite area. The principal mines, now all abandoned, are listed below, with their reputed production.⁶

Line Pit, three-quarters of a mile northwest of Rock Springs cross-roads, Maryland; 1,000 tons. This chromite body presents a number of unusual features, and is in some respects the most remarkable deposit in the district.

The deposit may be described as a rough, irregular cylindrical mass, with the average diameters of 5 by 8 feet, which has been worked to a depth of about 250 feet. The chromite body pitches S 75° E at an angle of about 60°.

This rough cylindrical mass is surrounded by a thick sheathing of a translucent green, jade-like serpentine known as williamsite, averaging about a foot in thickness, beyond which lie the ordinary types of serpentine. Thick tabular masses of williamsite form partings in the chromite deposit, while veins of it may extend into the serpentine walls. Fractures in the chromite are filled with clinochlore or kammererite. Many veins of magnesite, containing residual masses of green serpentine, were found cutting the chromite deposit and the serpentine in the lower levels.

Reynolds' Mine, one and a half miles south of Wrightsdale; production small.

Wood's Mine, one mile southwest of Lee's Mill; 120,000 tons. The Wood's Mine chromite deposit formed an enormous, irregular mass, in a dark green serpentine, which assumes a brown coating on weathering. The deposit was worked to a depth of 720 feet. The greatest length along the strike was 300 feet, with a width of 10 to 35 feet, and a pitch of 40° to 60°. The strike was nearly E. and W. at the outcrop, and N. and S. on the lower levels. Branches of the chromite body occasionally extended into the serpentine.⁷

Adjacent to the chromite, the serpentine showed a prismatic structure, the cracks of which extended normally to the chromite for a distance of a half inch or more, and were filled with deweylite or magnesite. This secondary phenomenon occurred during the serpentinization of the peridotite or pyroxenite, and indicates that

⁶ For a map see these PROCEEDINGS Vol. 73, p. 174.

⁷ Persifor Frazer, Jr., Second Geol. Surv. Penna. Rep. C3, 1880, 192-196. William Glenn, Trans. Am. Inst. Min. Eng. 25, 481-499, 1896.

the chromite deposit was formed prior to the serpentinization. A similar structure is found in the serpentine adjacent to magnetite veins in Brinton's Quarry, three miles south of West Chester, Chester County, Penna.

The following minerals were found associated with the chromite, clinochlore, kammererite, uvarovite, brucite, hydromagnesite, genthite, and zaratite.

Red Pit, one-half mile northeast of Line Pit; production unknown.

Jenkin's Pit, three-eighths of a mile northeast of Red Pit; 1,000 tons. This mine has been abandoned for a number of years, and the writer's observations were limited to the material on the dumps.

In addition to massive chromite much disseminated chrome, known as "birds-eye ore" was mined. The chromite deposits occurred in dark brown, light to dark-greenish, or almost black serpentines, which under the hand lens are seen to consist of greenish translucent grains. Under the microscope the serpentine shows characteristic mesh structure with residual grains of olivine (fig. 1). The disseminated chromite occurs as rounded grains in a light greenish serpentine, with residual olivine. Occasional grains of serpentinized olivine are found entirely enclosed by chromite (fig. 2), and study of thin sections indicates that the chromite crystallized out from the magma contemporaneously with the olivine.

The clinochlore and kammererite form druses in the chromite, having been deposited by hydrothermal solutions, perhaps during the process of serpentinization. The genthite and zaratite are due to the weathering of minute amounts of an undetermined nickel sulfide present in the chromite.

Carter's Mine, three-eighths of a mile east of Wood's Mine; 400 tons.

Scott's Mine, two miles southwest of Nottingham; 3,000 tons.

Moro Phillips' Mine, one mile south of Nottingham; 250 tons.

In addition a number of smaller pits have produced from 20 to 50 tons, while more than 5,000 tons of sand chrome has been reported to have been obtained by washing the stream sands of the region.

An abandoned magnetite mine is situated one-and-a-quarter miles northeast Rock Springs cross-roads, Maryland.

The Serpentes. The serpentines forming the country rock are largely brownish or greenish rocks, which are seen under the hand lens to consist of small greenish, translucent grains, separated by films of magnetite particles. Under the microscope some of the

grains exhibit mesh structure and contain residual olivine; indicating that the parent rocks were largely peridotites of the type



Fig. 1.



Fig. 2.

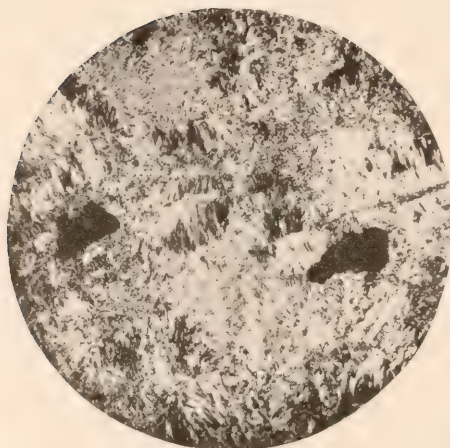


Fig. 3.

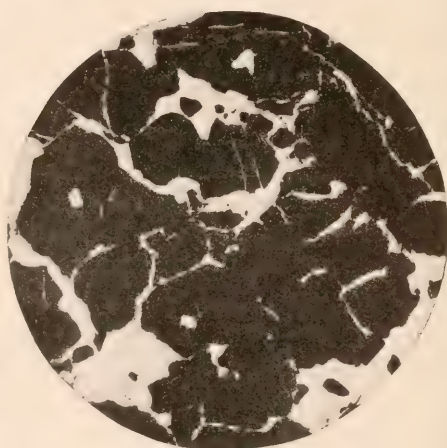


Fig. 4.

Fig. 1. Serpentinization proceeding along cracks in olivine. Jenkin's Mine. Ordinary light, x 15. Fig. 2. Chromite, "birdseye ore," in more or less serpentinized olivine. Note rounded form of chromite and serpentinized olivine crystal in the chromite. Jenkin's Mine. Ordinary light, x 15. Fig. 3. Chromite in fibrous williamsite. Line Pit. Polarized light, x 15. Fig. 4. Chromite in williamsite. Note fractured character of the chromite. Line Pit, ordinary light, x 15.

saxonite, composed of olivine and enstatite. A pseudo-porphyrific type is found consisting of a light grayish-green serpentine, with small patches rich in magnetite, the particles of which are arranged in definite patterns, indicating a possible derivation from a ferri-ferous pyroxene, probably hypersthene.

The williamsite is a compact, green, translucent, jade-like serpentine, which under the hand lens shows a fibrous structure. Under polarized light the rock is seen to be composed of aggregates of fibres polarizing in first order gray and yellow colors (fig. 3). Rarely minute particles of a silver-white undetermined nickel sulfide may be found in the williamsite. Mesh structure is absent and no traces of the parent mineral from which the williamsite is derived occurs. The writer considers the mineral to have been derived from enstatite by hydrothermal metamorphism.

Analyses of the williamsite are given below, showing it to be a pure serpentine.

ANALYSES OF WILLIAMSITE

Line Pit, Lancaster County, Penna. Smith and Brush; Am. J. Sci. (2) 15 213, 1853.

	A	B
SiO ₂	41.60	42.60
Al ₂ O ₃	tr.	tr.
NiO.....	0.50	0.40
FeO.....	3.24	1.62
MgO.....	39.71	41.11
H ₂ O.....	12.70	12.70
	99.15	99.22

Chromite. The chromite forms granular black masses, and contains some disseminated williamsite. In very thin sections the mineral shows a reddish translucency, and evidence of fracturing during the period of serpentinization (fig. 4).

- *Origin of the Line Pit deposit.* It is at once apparent from the form and position of the Line Pit deposit that it was formed later than the surrounding rock. Unfortunately but little is known regarding the behavior of chromite in igneous melts, beyond the fact that its occurrence is limited to the ultrabasic rocks and that it begins to crystallize early, and the period of its crystallization may overlap that of the enstatite.

That the chromite deposit had been formed previous to the serpentinization is indicated by the evident fracturing of the chromite grains (fig. 4) which occurred during this process.

It seems, therefore, that after most of the magma had crystallized into the peridotite, and the pipe-like mass of liquid was injected into the peridotite, where after further differentiation, the material crystallized into enstatite and chromite. Hydrothermal solutions later altered the enstatite to williamsite.

The Line Pit, Red Pit, Jenkins' Mine and Reynolds' Mine deposits all fall on a line on the map. The significance of this is not known.

A FOSSIL OWL FROM THE BRIDGER EOCENE.

BY ALEXANDER WETMORE.

In 1873, Dr. Joseph Leidy described some fragments of bone, supposed to be those of a large lizard from the Bridger deposits of Wyoming as *Saniwa major*, basing this name on the distal end of a humerus and two fragmentary vertebrae. The type specimens preserved in the collections of the Academy of Natural Sciences of Philadelphia were borrowed recently by Mr. C. W. Gilmore, who had recognized that the type material was probably composite, and to him and to Dr. Witmer Stone, I am indebted for permission to study the humerus in question, which proves to be that of a bird.

Though Dr. Leidy considered this humerus as lacertilian, and compared it with that of a monitor, it is readily seen that it does not belong in this group as there is no sign of an epiphysis on the articular end of the bone. The specimen is well fossilized, and is dark green in color save along the condyles, where it is lighter and has a somewhat chalky appearance, a circumstance that perhaps led to its allocation in the Sauria, as it may have been thought that this lighter area was epiphysial in character.

The two broken vertebrae mentioned must stand as the type of *Saniwa major* Leidy and are hereby so designated. The avian humerus, representing an owl of the family Bubonidae, may be known as

Minerva saurodosis sp. nov.

Characters.—Distal end of humerus (figs. 1 and 2) similar in general form to *Bubo virginianus* (Gmelin) but smaller, with radial and ulnar trochleae reduced in size; ulnar trochleae less produced distally toward outer end; angle at base of ulnar condyle on inner anterior face sloping gently (not abrupt); surface above entepicondylar process broader, less elevated, sloping gradually into brachial depression; entepicondylar process slighter, lateral margin of bone above ectepicondylar process relatively less broadened, with more rounded margins, expanding to support entepicondyle; shaft expanding somewhat to support ectepicondylar process.

Description.—Type, Acad. Nat. Sci. Philadelphia, no. 9131, distal end of left humerus, from near "Lodge-Pole Trail Crossing Dry Creek," about ten miles from Fort Bridger, Wyoming; Eocene

(Bridger formation), collected by Dr. James Van A. Carter, between 1869 and 1872.

A bird slightly larger than the Barred Owl, *Strix varia* Barton; smaller than the Great Horned Owl, *Bubo virginianus* (Gmelin).

Distal end of humerus much expanded as in other owls, the diameter across the condyles nearly twice that of the shaft; end of ectepicondylar process broken away, the shaft sloping out to support base of process; lateral epicondyle produced, shelf-like, between base of ectepicondylar process and radial trochlea, confluent inwardly with base of shaft, with outer margin below ectepicondylar process raised so that the shelf appears excavated (concave), changing outwardly to a shallow groove delimiting the external face of the radial trochlea and disappearing as it comes to the summit of the articular surface; radial trochlea short, roundly elevated, slightly sigmoid in outline, bulging over shelf of lateral epicondyle, sharply declivous on opposite side, at inner end forming a right angle with shaft; ulnar trochlea relatively small, not abruptly elevated above shaft on inner side (articular surface slightly weathered away so that a slight angular tip was formerly present), slender toward outer margin, so that rounded articular head is reduced; intertrochlear



FIG. 1.
Minerva sauro-
dosis. Anterior
view of type.

groove narrow, with sharp slope toward radial side and more gradual one opposite toward ulnar trochlea; attachment for pronator brevis extensive, roughly elliptical in outline, relatively more extensive than in modern owls as it is nearly as long as globular portion of ulnar trochlea; attachments for pronator longus and flexor carpi ulnaris roughly rounded, well impressed; outer face of median epicondyle expanded on both margins, appearing as a somewhat elliptical expansion at lower end of shaft, slightly impressed on outer face above base of entepicondylar process; depression for brachialis inferior distinct but only slightly impressed, more distinct toward ulnar margin; olecranal depression fairly deep, abruptly delimited against median epicondyle, with extent less sharply cut off by expansion of ulnar trochlea, merging imperceptibly into shaft forward; sulcus anconeus lateralis narrow, shallowly and regularly concave, disappearing after leaving lateral epicondyle; sulcus anconeus medius broad, divided into two unequal parts by a slightly raised line passing from upper margin of olecranal fossa obliquely to margin of shaft at point where the lateral epicondyle tapers gradually into straight shaft; bone hollow.

Measurements (in millimeters).—Lateral breadth of shaft above depression for brachialis inferior 8.5; breadth across distal end 18.7;



FIG. 2.
Minerva sauro-
dosis. View of
condyles.

extreme length of radial trochlea 7.8; greatest length of attachment for pronator brevis 6.

Range.—From Bridger formation, Eocene, near Fort Bridger, Wyoming.

Remarks.—The broken humerus described above, here exhumed from a resting place among its cold-blooded relatives, the lizards, represents an owl smaller than *Bubo virginianus*, similar in size to *Pulsatrix perspicillata* (Latham), that does not resemble closely any existing genus of modern North American owls but in a way combines characters pertaining to several. *Minerva saurodosis* was apparently a bird of moderate flight, as processes for muscle attachment, while strong, are not rugged as they are in the Great Horned and Snowy Owls that perform extended migrations. In general outline the humerus of *M. saurodosis* suggests that of *Bubo* but with the processes and tubercles developed even to a less degree than in the Barred Owl, Spotted Owl, or *Pulsatrix perspicillata*. It is judged that it may have been a resident species.

The generic allocation of this ancient owl is more or less tentative. In 1913, Dr. R. W. Shufeldt¹ described as *Aquila antiqua* the hind claw of a bird collected August 4, 1905, by W. J. Sinclair in the Bridger formation at Church Buttes, Wyoming. Later², Dr. Shufeldt, after study of further material, decided that this species should be relegated to the owls and set up the genus *Minerva* to receive it. The species, of a size much larger than any existing North American Owls, was characterized by the great prolongation of the dorsal articular surface of the hind claw. This upper angle projects until the articular facet forms almost half of a circle. This character, while more pronounced in owls than in other groups that I have examined (much more than in available Accipitriformes) reaches a development in *Minerva* far beyond that of any modern owl that I have seen. To allow flexibility in movement it must have been received in a deeper pit than ordinary on the distal end of the digital phalanx. Otherwise the hind claw would have had little power of backward flexion. A structure similar to this type of articular facet would be formed by ankylosis of the sesamoid found at the upper end of the claw articulation in many lizards, with the end of the bone.

¹ Bull. Am. Mus. Nat. Hist., Vol. XXXII, Aug. 4, 1913, p. 297.

² Trans. Connecticut Acad. Arts Sci., Vol. 19, Feb., 1915, p. 43.

As *Minerva antiqua* represents a specialized type of owl from the Bridger formation it seems more logical at present to describe the present species, also a peculiar form from the same deposits, in the genus *Minerva* than to erect for it a new genus. With further material the two may be found widely and trenchantly separated. For the present, *Minerva saurodosis* is to be distinguished from *M. antiqua* by its much smaller size. Strangely enough *M. saurodosis* as represented by this broken humerus has little resemblance to *Tyto*, a possible indication of the archaic origin of the Barn Owl, while to go farther afield it shows little to suggest any of the Goat-suckers or the Oil-bird (*Steatornis*). In other than generalized group resemblances there is in fact slight connection evident between it and any of the other Coraciiform suborders. There are certain resemblances to the Anisodactylae (Kingfishers, Todies, Motmots, etc.), as well as to the superfamily Galbuloidae of the Picariae, containing the Jacamars and Puff-birds, but these similarities are not close.

SCROPHULARIACEAE OF THE WEST GULF STATES.

BY FRANCIS W. PENNELL.

This study deals with the plants of the family Scrophulariaceae occurring in the area west of the Mississippi and east of the Pecos rivers, in the states of Arkansas, Oklahoma, Louisiana and Texas. It follows closely the manner of presentation of the account of the "Scrophulariaceae of the Southeastern United States," which appeared in these Proceedings¹ in 1920, and the introduction to that paper will in most points apply to this.

To the West Gulf states I have made two collecting-trips, one in spring and one in early autumn. The latter, the first in point of time, was in 1913 through central Oklahoma, central and southeastern Texas, Louisiana, and Arkansas, and was in search of the plants herein classed in the tribe Buchnereae. Nearly every species of these genera was found and descriptions were made of the form and color of corolla and other evanescent features. This study was undertaken on behalf of the University of Pennsylvania and its results still await publication in the "Contributions from the Botanical Laboratory" of that institution. Unexpectedly therefore, a number of new species and geographic varieties will first appear on these pages.

In late April and May of 1920 I visited all of these states for early-flowering species, obtaining in chief variety species of the genera *Penstemon* and *Castilleja*. This second journey, made in the interests of the New York Botanical Garden, took me across southern Louisiana and Texas to Corpus Christi, inland through central Texas and up to the Staked Plains of the northwest, across Oklahoma from west to east, and across the Ozark Mountains and into the pineland of eastern Arkansas. Neither route need now be cited in detail, as all localities are given in the lists which, classified by counties, accompany each species. Suffice it to say for both trips, the field-descriptions obtained, and the observations of the limits of variation of each species, have been beyond

¹ Proc. Acad. Nat. Sci. Phila. 71: 224-291. 1920.

value. In this manner, group by group, should all our vast body of herbarium-conclusions be checked and re-valued in the field!

The tribe least studied in this area is the Gratioleae. These are summer-blooming and unfortunately were not included among the special objects of search of my first journey. However, only in *Gratiola* do I feel this loss, and it remains for some future worker to give us needed information of *G. gracilis* and *G. flava*. Most of the tribe but slightly enter the area from the East Gulf states and are species well-known eastward. Of other tribes, I particularly deplore not finding in blossom *Leucophyllum*, said to be one of the finest ornamental shrubs of Texas. Species of still other tribes were missed, but, while it would have been a pleasure to have seen what must be among the most showy members of their respective genera, *Penstemon murrayanus* and *Castilleja purpurea*, yet such distinct species are not in need of close analysis.

When the attempt is made to express in terms of natural areas of distribution the ranges of various species over an area such as this, one realizes how far ahead is still any comprehensive outlining of phytogeographic areas in our country. However, I have tried to use terms that have some definiteness, physiographic or geologic. In Louisiana and eastern Texas we have some preliminary sketches by Roland M. Harper², in Texas the outlines of Vernon Bailey³, W. L. Bray⁴, and R. T. Hill⁵, and in both Texas and Oklahoma excellent geological maps. In each state careful state surveys of plant and animal distribution are needed, and such tasks should call forth local enthusiasm. Mr. Bailey's study is the most accurate of those seen, and applies carefully the system of life-zones evolved by the Biological Survey. Although I am an ardent devotee of this system when applied in mountainous regions, I can but wonder what value a life-zone outline can be in such a land as Texas. Life-zones lay stress upon the one factor of temperature; in the Rockies and Andes the limits of bands of temperature-controlled vegetation are distinct enough, but surely across flat and rolling Texas the student of distribution must pay more attention to moisture and soil. However, for

² Bull. Torr. Bot. Club 47: 289-317. f. 1-5. 1920.

³ N. Am. Fauna 25: 1-222. pl. 1-16, f. 1-24. 1905.

⁴ Bull. Univ. Texas 82: 1-108. pl. 1-14, f. 1-4. 1906.

⁵ Physical Geography of the Texas Region (Topog. Atlas U. S. A., Folio 3) 1-12. f. 1-66. 1900.

species of upland Texas, following Bailey's map, I have given life-zone—but only to make as definite as possible my statement of range. Usually I have been content with other terms. Nearly everywhere through the West Gulf states, I have found collections so few and remote as to make any statement of range only a skeleton outline and a study of probabilities.

We have quite insufficient collections from the West Gulf states. Yet that there are many who have had some interest in this flora the list of collectors at the close of this article testifies. To all these collectors I feel my indebtedness; as also I am under obligations to the curators of the several herbaria, also listed herewith, who have placed at my disposal the material in their care. The Missouri Botanical Garden has undertaken a special investigation of the plant-life of the West Gulf states, and Mr. Ernest J. Palmer's work is giving us our best understanding of their flora.

In the present outline, as in the study of southeastern Scrophulariaceae, are given full keys to contrasts noted, but these made to apply only to species of the area considered. A further modification of the phylogeny of this family, one which was introduced in my study of the "Scrophulariaceae of Colombia," is to consider *Mimulus* as a tribe apart from the Gratiroleae. Synonymy is now given, and the application of each name explained; again this data is only given as it pertains to native species or to species proposed from this area. Available typic and isotypic material has been studied, and the Academy's herbarium has proven rich in the types of Nuttall's and of Leavenworth's Arkansas species.

To show the basis for the summaries of distribution, and to enable others from other view-points to work with this data, I am citing for native species all localities from which specimens have been seen. These are listed by states, and alphabetically by counties, the name of the county being followed by a colon. One collection to a county is cited. The letters in parentheses following the collection-entry refer to the herbarium in which the specimen may be consulted, and their application may be found from the list of herbaria given at the end of this paper.

Corolla with the posterior lobes external in the bud.

(ANTIRRHINOIDEAE.)

Capsule septicidal or loculicidal by a simple slit, the septum breaking from the capsule-wall or rupturing. Corolla not spurred nor saccate anteriorly.

Stigma two-lipped. Inflorescence simply racemose. Leaves opposite. Herbs.

Capsule septicidal, or secondarily also somewhat loculicidal; placentae simple. Sepals distinct or nearly so. Leaves and capsule somewhat glandular-punctate.

I. GRATIOLEAE.

Capsule loculicidal (only tardily septicidal, if at all); placentae branched and widely spreading. Sepals united over one half length. Leaves and capsule not glandular-punctate.

II. MIMULEAE.

Stigma capitate. Capsule septicidal.

Leaves alternate. Plant frequently with stellate hairs.

Corolla slightly zygomorphic. Filaments all with fertile anthers. Inflorescence simply racemose.

Corolla yellow or white, rotate, its lobes much longer than the tube. Filaments five. Herbs.

III. VERBASCEAE.

Corolla rose-pink with orange markings, campanulate, its lobes shorter than the tube. Filaments four (the posterior lost). Shrub.

IV. LEUCOPHYLLEAE.

Leaves opposite. Plant never with stellate hairs. Corolla tubular-campanulate, zygomorphic, its lobes shorter than the tube. Filaments five, the posterior without anther, the others didynamous. Inflorescence simply racemose, or of cymose fascicles. Herbs.

V. CHELONEAE.

Capsule loculicidal, the septum and adjacent capsule-wall persisting, the remaining wall splitting irregularly. Corolla saccate or spurred at base of anterior petal. Leaves alternate. Herbs.

VI. ANTIRRHINEAE.

Corolla with the anterior lobes external in the bud. Herbs.

(RHINANTHOIDEAE.)

Stamens two, the postero-laterals present, the antero-laterals completely lost. Antero-lateral lobes of corolla external in bud. Not parasitic. Sepals four, the posterior lost. Posterior lobes of corolla completely united. Capsule loculicidal.

VII. VERONICEAE.

Stamens four, didynamous, the antero-laterals usually slightly the longer. Usually, perhaps always, parasitic on the roots of other plants.

Sepals five, alike, more or less united. Corolla-lobes all somewhat distinct, the two posterior spreading or arched or flattened; anterior lobe external in the bud. Capsule loculicidal.

VIII. BUCHNERAE.

Posterior sepal shorter or wanting. Corolla decidedly two-lipped, the posterior lobes united and arched nearly to apex, the anterior lobes shorter; anterior or one antero-lateral lobe external in the bud. Capsule septicidal or loculicidal.

IX. RHINANTHEAE.

1. GRATIOLEAE.

Leaves entire to serrate. Seeds brown or yellow.

Corolla with the ridges to the antero-lateral sinuses low and not projecting beyond those points (so anterior filaments simple). Posterior lobes of the corolla little shorter than the anterior. Seeds reticulate or longitudinally striate. Pedicels frequently bibracteolate.

Anther-sacs proximate, no connective arms developed.

Seeds reticulate. Leaves not cordate clasping at base.

Pedicels bibracteolate (or in *Gratiola* the bractlets sometimes several, one or wanting). Leaves pinnately veined (except in *Hydrotrida*). Styles united throughout. Sepals five, acute or obtuse.

Pedicels bracted at base (remote from the calyx).

Corolla yellow or white, pubescent within at base of posterior lobes. Stamens four. Sepals unequal, and leaves serrate. Plants erect or ascending.

1. *Mecardonia*.

Pedicels bracted at apex (just beneath calyx).

Fertile filaments two, the anterior being rudimentary or wanting. Corolla yellow or white, its tube much longer than the lobes. Outermost sepal never more than twice width of innermost. Plants erect.

Corolla-tube broad, within densely pubescent on the posterior side. Sepals of nearly uniform length. Plants relatively lax or succulent, the leaves and sepals plane.

2. *Gratiola*.

Corolla-tube very narrow, within uniformly short-pubescent on all sides. Sepals very unequal in length. Plant stiff, the leaves and sepals revolute.

3. *Sophranathe*.

Filaments four, all with anthers. Corolla blue or white, its tube little longer than the lobes. Outermost sepal over twice width of innermost. Plants repent.

Corolla pubescent within over bases of all lobes, blue throughout; posterior lobes united to apex. A circle of bristles surrounding the base of the ovary. Outer sepal slightly cordate, evidently exceeding the linear-attenuate innermost. Capsule less than one half as broad as long. Pedicels spreading in fruit. Leaves clasping, broadest proximally, crenate, with five to seven longitudinal nerves. Stem pubescent. Plant lemon-scented.

4. *Hydrotrida*.

Corolla glabrous within, the throat yellow, the lobes white; posterior lobes distinct. No hypogynous bristles. Outer sepal ovate, scarcely exceeding the lanceolate innermost. Capsule over one half as broad as long. Pedicels reflexing in fruit. Leaves cuneate at base, spatulate-oblong, entire, with one evident longitudinal nerve. Stem glabrous. Plant inodorous.

5. *Bramia*.

Pedicels not bracteolate. Leaves palmately veined. Styles distinct near apex. Sepals four or five, very obtuse, unequal in width. Corolla white. Plants repent; the stems pubescent.

Corolla 7-8 mm. long, five-lobed (because the two posterior and the three anterior lobes are all developed and distinct). Stamens four. Sepals five or four. Leaves entire.

6. *Macuillamia*.

Corolla 2 mm. long, three-lobed (because the two posterior lobes have united, and the anterior petal is lost leaving the anterior lip two-lobed). Stamens three (only one of the antero-lateral pair developed). Sepals four. Leaves repand.

7. *Hydrathelium*.

Anther-sacs separated on short arms of the connective. Seeds longitudinally striate, the striae tuberculate. Leaves cordate-clasping at base. Corolla blue. Pedicels bibracteolate. Plants erect or repent; the stems pubescent.

8. *Stemodia*.

Corolla violet-blue or white, with two raised ridges (each formed by the adherence of a filament) to the antero-lateral sinuses and which project as knob-like processes beyond those points (the free portion of the filament appearing as a lateral outgrowth of the adherent portion.) Posterior lobes of the corolla less than two thirds the length of the anterior. Seeds with fine transverse lines. Pedicels never bracteolate. Perfect stamens two.

Corolla violet-blue, 6-11 mm. long, the posterior lobes distinct distally. Postero-lateral stamens perfect, the antero-lateral filaments without anthers. Style with an enlarged white base. Sepals five. Capsule two-celled, oval in outline, 2-5 mm. long. Plants erect or ascending.

9. *Ilysanthes*.

Corolla pale-lavender or white, 1.5-2 mm. long, the posterior lobes united throughout. Postero-lateral stamens lost, the antero-lateral filaments with anthers. Style filamentous to base. Sepals four (the posterior

lost). Capsule one-celled at maturity (by loss of septum distally, the placentae being short), globose, 1 mm. long. Plant repent. 10. *Globifera*.

Leaves bipinnatifid. Seeds pale greenish-yellow, ridged, with faint transverse lines. Corolla lavender. Pedicel not bracteolate. Plant erect. 11. *Leucospora*.

II. MIMULEAE.

12. *Mimulus*.

III. VERBASCEAE.

13. *Verbascum*.

IV. LEUCOPHYLLEAE.

14. *Leucophyllum*.

V. CHELONEAE.

Seeds angled, maturing many to a cell. Corolla-lobes uniformly colored, shorter than the tube which is not pouched at base posteriorly. Posterior filament a conspicuous process. Sepals nearly or quite distinct. Inflorescence compound. Plants perennial, stiff, 3-20 dm. tall.

Corolla 15-50 mm. long, red, blue, or white, its three anterior lobes projecting or slightly recurving. Sterile filament elongate, slender, white. Sepals 3-13 mm. long. Seeds irregularly polyedral. Inflorescence a thyrsus or relatively narrow panicle. Cauline leaves sessile, mostly clasping. Stem terete. 15. *Penstemon*.

Corolla 6-12 mm. long, red-brown, its antero-lateral lobes vertically projecting and its anterior lobe deflexed. Sterile filament wider than long, two-lobed, yellow or brown. Sepals 2.5-3 mm. long. Seeds oblong, ridged. Inflorescence a panicle. Cauline leaves petioled. Stem quadrangular. 16. *Scrophularia*.

Seeds rounded, smooth, maturing one to each cell. Anterior corolla-lobes blue, the posterior white, all longer than the tube which is strongly pouched at base posteriorly. Posterior filament a crescentic scarcely raised process. Sepals united over one third length, enclosing over half the capsule. Inflorescence racemose, often several flowers to an axil. Plant annual, lax, 1-3 dm. tall. 17. *Collinsia*.

VI. ANTIRRHINEAE.

Corolla broad (10 mm. wide), blue, with prominent yellow palate, its tube saccate at base anteriorly. Sepals 8-10 mm. long. Leaves petioled, the blade triangular, hastate with broad lobes. Stems elongate, twining.

18. *Maurandya*.

Corolla narrow, yellow or blue, its tube with a conspicuous spur at base anteriorly. Sepals 3 mm. long. Leaves sessile, linear. Stems erect. 19. *Linaria*.

VII. VERONICEAE.

Leaves whorled. Corolla white or pinkish, its lobes shorter than the tube. Capsule acute, longer than wide, not flattened, dehiscing by short apical slits. Seeds slightly reticulate. Plant 10-20 dm. tall. 20. *Veronicastrum*.

Leaves opposite or alternate. Corolla blue or white, its lobes longer than the tube. Capsule truncate to deeply notched, wider than long, flattened, dehiscing its entire length. Seeds not reticulate. Plants lower.

21. *Veronica*.

VIII. BUCHNEREAE.

Corolla yellow or pink, the throat inflated and the orifice widely open. Stamens all with anthers two-celled. Filaments and style nearly as long as or longer than the tube of the corolla. Capsule exserted from the calyx-tube. Pedicels not bracteolate.

Anther-cells glabrous or with a few bristle-like hairs at apex.

Stigma short, punctiform or capitate. Filaments dilated-flattened and pubescent. Corolla yellow.

Corolla densely pubescent within on all sides, its lobes all distinct and slightly shorter than the tube. Filaments clearly didynamous, dilated and pubescent throughout. Anther-sacs each opening by a slit its entire length. Style short, thick, more or less bilobed, persistent and reflexed on the capsule. Pedicels 1-2 mm. long. Plant stout, 15-20 dm. tall, the leaves 10-30 cm. long.

22. *Dasistoma*.

Corolla slightly pubescent within (in a ring about the base of the filaments and below the posterior sinus), its lobes longer than the tube, the two posterior united nearly one half their length. Filaments nearly equal, dilated and pubescent proximally for not over half their length. Anther-sacs each opening by a slit not over half its length. Style long, slender, entire, deciduous, straight. Pedicels 3-12 mm. long. Plants more slender, 2-10 dm. tall, the leaves 1-3 cm. long.

23. *Afzelia*.

Anther-cells lanose on the valvular surface. Stigma linear, consisting of a line down each side of the linguiform style-apex. Filaments slender, not dilated, more or less lanate.

Corolla yellow. Capsule acute to acuminate. Leaves lanceolate to ovate, entire to bipinnatifid, petioled. Stem stout, over 5 dm. tall. 24. *Aureolaria*.

Corolla pink, with red spots within on the anterior side. Capsule rounded, with a mucro. Leaves filiform to lanceolate, sessile. Stem usually slender.

Stem ascending-scabrous to glabrous. Leaves lanceolate to filiform, entire or slightly lobed at base. Pedicels 1 mm. long or more. Calyx-lobes linear to subulate, slightly longer than to much shorter than the tube. Anther-sacs of both pairs of stamens uniform. Capsule oblong to globose, 3-11 mm long. Seeds closely reticulate. 25. *Agalinis*.

Stem retrorse-hispid. Leaves lanceolate and usually auricled at base, or bipinnatifid. Pedicels less than 1 mm. long. Calyx-lobes ovate, longer than the tube. Anther-sacs of posterior stamens shorter. Capsule ovate, 8-13 mm. long. Seeds reticulate with raised ridges. 26. *Otophylla*.

Corolla purple-blue or white, salverform, the tube very narrow and densely pilose within, the lobes widely spreading. Stamens each with but one anther-sac developed. Filaments and style less than one half length of corolla-tube. Capsule mostly or quite enclosed within calyx-tube. Pedicels bibracteolate. 27. *Buchnera*.

IX. RHINANTHEAE.

Sepals five, all distinct, the posterior shorter than the others. Pedicels bibracteolate. Capsule turgid, septicidal, only tardily slightly loculicidally dehiscent. Seeds linear, flat, 2 mm. long. 28. *Schwalbea*.

Sepals four, those of each side united, the posterior one wanting. Pedicels not bracted. Capsule flattened, loculicidal, splitting even across the septum. Seeds turgid.

Corolla greenish to yellow distally, the posterior lobes projecting, not hooded at apex, the anterior lobes much shorter and at least proximally somewhat thickened and deep-green. Capsule cylindric, equally two-celled, in dehiscence splitting on both posterior and anterior sides; shorter than and enclosed within the calyx. Seeds many, reticulate. Bracts foliaceous, usually distally yellow or red. Leaves entire to pinnatifid-lobed. 29. *Castilleja*.

Corolla yellow throughout, the posterior lobes arched, hooded at apex, the anterior lobes well-developed, membranous, thin, colored. Capsule ensiform, unequally two-celled, splitting only on the posterior side; exserted from and twice the length of the calyx. Seeds few, not reticulate. Bracts not colored. Leaves bipinnatifid-lobed. 30. *Pedicularis*.

1. MECARDONIA Ruiz and Pavon.

Mecardonia R. and P., Syst. Veg. Fl. Peruv. et Chil. 164. 1798.

Type species, *M. ovata* Ruiz & Pavon, of Peru.

Corolla white, its posterior lobes united $\frac{1}{2}$ - $\frac{2}{3}$ their length. Outer sepals lanceolate, rarely more than twice width of inner. Leaf-blades prevailingly lanceolate, conspicuously cuneate at base. Erect or somewhat diffuse.

1. *M. acuminata*.

Corolla yellow, its posterior lobes united nearly to apex. Outer sepals narrowly ovate to ovate, more than three times width of inner. Leaf-blades prevailingly ovate or oval, more shortly cuneate at base. Procumbent or ascending.

2. *M. peduncularis*.

1. ***Mecardonia acuminata*** (Walt.) Small.

Gratiola acuminata Walt., Fl. Carol. 61. 1788. Type not verified, but description evidently of plant here considered. Doubtless from lower South Carolina where this plant is common.

Pagesia leucantha Raf., Fl. Ludov. 49. 1817. "Chelone 2. Rob. p. 406." In Robin, Voy. Louisiane . . . 3: 406. 1807, is a description unmistakably of the plant here considered. Robin even mentions two little leaflets in each leafaxil, by which are evidently denoted the bractlets subtending the base of the pedicel, the presence of which has been generally overlooked. Type of genus *Pagesia* Raf., l. c. 48.

Gratiola rigida Raf., Atl. Jour. 1: 176. 1833. "Texas (or) Arkansas, in my Herbarium." Type not known to exist. Description can apply to only this species, the rigid stems, leaf-outline, and narrow calyx-lobes with the superior one broader, being distinctive.

Mecardonia acuminata (Walt.) Small, Fl. S. E. Un. St. 1065, 1337. 1903.

Corolla white, within with longitudinal pink veins on the posterior side. Flowering from May to September, and soon ripening fruit.

Moist sandy loam, or heavier loam soil, usually near streams, in pineland or deciduous woodland, frequent or common through the Coastal Plain of eastern Arkansas, Louisiana and eastern Texas (probably absent from the Mississippi bottom-land); also inland, probably along sandy river- and creek-beds to eastern Oklahoma. Ranges from Maryland to Florida and Texas, extending inland to western Kentucky, southern Missouri and eastern Oklahoma.

ARKANSAS. Hot Spring: Eggert (Y). Jefferson Springs, Pennell 10662 (Y). Miller: Texarkana, Letterman (Y). Nevada: Prescott, Letterman (U). Pulaski: Little Rock, Hasse (Y).

OKLAHOMA. Creek: Sapulpa, Bush 407 (U, Y).

LOUISIANA. Caddo: Shreveport, Gregg (A). Calcasieu: DeQuincy, Pennell 10229 (Y). West Carroll: —, Moseley (U).

TEXAS. Bowie: Texarkana, Heller 4170 (A, U, Y). Brazoria: Columbia, Bush 1413 (A, Y). Harris: Harrisburg (U); Houston, Fisher 1744 (U).

2. *Mecardonia peduncularis* (Benth.) Small.

Herpestis peduncularis Benth. in Compan. Bot. Mag. 2: 56. 1836. "Hab. Texas on the Rio Brazos, Drummond (v. s.)." Type not verified, but description sufficiently distinctive.

Mecardonia viridis Small, Fl. S. E. Un. St. 1065, 1338. 1903. "Type, Heller, Pl. So. Tex., no. 1460, in Herb. C. U." Type, collected at Corpus Christi, Nueces Co., Texas, Mar. 14-21, 1894, seen in Herb. Columbia University at the New York Botanical Garden.

Mecardonia peduncularis (Benth.) Small, l. c. 1065, 1338. 1903.

Closely allied to the wide-spread Tropical *Mecardonia procumbens* (Miller) Small, but apparently distinguishable by narrower outer sepals and longer pedicels. *M. tenuis* Small of the Florida Keys and the Bahamas seems to differ constantly from this in possessing sepals 5-6 mm. long instead of 7-9 mm. long.

Corolla yellow, within with longitudinal brown veins especially on the posterior side. Flowering from March to May, and soon ripening fruit; lingering blossoming later.

Sandy or clayey soil, prairie or open woodland, common on the Coast Prairie of middle coastal Texas, frequent inland across the Coastal Plain and along stream-courses entering the hills of the Edwards Plateau and the Burnet Metamorphic Region; ranges from Walker and Brazoria to Burnet, Bexar and Duval counties, Texas.

TEXAS. Austin: Kenney, Pennell 10305 (M, T, Y); Wallis, Pennell 10269 (C, P, U, Y). Bexar: Comanche Spring, Lindheimer 1054 (A, T, U, Y); San Antonio. Blanco: Blanco, Reverchon 1574 (U). Brazoria: Columbia, Bush 134 (U, Y). Burnet: Fairland, Pennell 10475 (A, H, K, Y). Marble Falls. Comal: Bracken; New Braunfels, Lindheimer 1055 (U, Y). Dewitt: Cuero, Bray 127 (U). Duval: San Diego, Croft (U). Gillespie: Jermy 168 (). Harris: Harrisburg, Pennell 10249 (H, Y); Houston, Pennell 10247 (Y), 10252 (C, M, Y), 10260 (A, H, J, L, M, O, P, S, T, U, Y). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Pennell 10378 (Y). Lampasas: Lampasas, Plank (Y). Nueces: Corpus Christi, Heller 1460 (A, U, Y). Travis: Barton Springs; Shoal Creek, Young (T). Victoria: Victoria, Lewton 96 (U). Walker: Huntsville, Young (T).

2. *GRATIOLA* Linné.

Gratiola L., Sp. Pl, 17. 1753.

Type species, *G. officinalis* L., of Europe.

Corolla slightly exceeding calyx, externally glabrous. Capsule nearly pyramidal, acuminate. Pedicels very short. Leaves

lanceolate-ovate to crenate, rounded at base. Plant pubescent with several-celled hairs.

1. *G. pilosa*.

Corolla at least twice as long as the calyx. Capsule broader, acute to rounded. Pedicels longer. Stem glabrous or pubescent with one-celled hairs, these frequently gland-bearing.

Corolla within throat on posterior side densely pubescent with knobbed hairs. Capsule ovate in outline, 1-5 mm. long. Seeds .3-.5 mm. long, semi-globose to oblong. Pedicels slender, at least twice the length of the sepals.

Capsule 1-2 mm. long, much exceeded by the sepals. Stem-leaves clasping by a broad base, denticulate, usually at least the upper with resinous dots. Root-stocks developed, perennial, slender.

2. *G. ramosa drummondii*.

Capsule 3-5 mm. long, about equaled by or longer than the sepals. Stem-leaves narrowed to a sessile or slightly clasping base, obscurely or not resinous-dotted. Roots apparently annual, the main root short.

Corolla-lobes white, the tube yellowish. Capsule globose-ovate, about equaled by the sepals. Seeds yellowish, the reticulations relatively fine and not making the seed rough in contour. Stems relatively thick and fleshy.

Corolla externally glandular-puberulent. Leaves 2-5 cm. long, ovate-lanceolate, serrate-dentate distally.

3. *G. neglecta*.

Corolla externally glabrous (apparently). Leaves .5-1.5 cm. long, nearly linear, entire.

4. *G. gracilis*.

Corolla golden yellow throughout, glabrous externally. Capsule ovate-pyramidal, nearly twice as long as the sepals. Seeds brown, the reticulations relatively coarse and making the seed rough in contour. Stem thin, not fleshy.

5. *G. flava*.

Corolla within throat on posterior side pubescent with unknobbed hairs. Capsule globose, 5-6 mm. long. Seeds .7 mm. long, linear. Pedicels stout, less than twice the length of the sepals. Leaves and root as in *neglecta*.

6. *G. virginiana*.

1. *Gratiola pilosa* Michx.

Gratiola pilosa Michx., Fl. Bor. Am. 1: 7. 1803. "Hab. in Carolinae inferioris uliginosis [A. Michaux]." Description sufficiently distinctive.

Corolla white, throat distally with faint bluish-purple lines on all petals. Flowering from June to September, and soon ripening fruit.

Moist sandy soil, pineland or deciduous woodland, through the Coastal Plain of eastern Arkansas, Louisiana, and eastern Texas. Ranges from New Jersey to Florida, central Arkansas, and eastern Texas.

ARKANSAS. Jefferson: Kearney, Pennell 10656 (Y). Pulaski: Little Rock, Letterman 359 (U, Y).

LOUISIANA. Calcasieu: De Quincy, Pennell 10237 (Y). Rapides: Alexandria, Hale (Y).

TEXAS. Austin: Kenney, Pennell 10304 (Y). Smith: Swan, Reverchon 3218 (U, Y). Weller: Hempstead, Hall 413 (U, Y).

2. *Gratiola ramosa drummondii* (Benth.) Pennell, comb. nov.

Gratiola drummondii Benth. in DC., Prod. 10:05. 1846. "In . . . Texas (Drummond! coll. 3. n. 285) . . . (v. s.)" Isotypes seen in herbaria of Columbia University at the New York Botanical Garden and of the Academy of Natural Sciences of Philadelphia.

Corolla with tube dull-yellow, the lobes dull-white, the tube with longitudinal brown lines. Flowering from April to September, and soon ripening fruit.

Moist or wet sandy pineland, edge of ponds, in and near pineland in the Coastal Plain of Louisiana and eastern Texas, probably in southeastern Arkansas; inland seen from the gravelly bed of the San Bois River in Haskell county, Oklahoma.

ARKANSAS. — : Leavenworth (Y).

OKLAHOMA. Haskell: San Bois River, Bigelow (U, Y).

LOUISIANA. Calcasieu: De Quincy, Pennell 10222 (A, H, K, L, M, T, U, Y); Lake Charies, Allison 296 (U, Y); St. Landry: Chat-eigner, Langlois (Y).

TEXAS. Angelina: — , Reverchon 3930 (U). Montgomery: Harmon's Creek, Dixon 453 (Y). Waller: Hempstead, Hall 412 (U, Y).

Apparently *Gratiola ramosa* Walt. (Fl. Carol. 61. 1788) includes two incipient species to be distinguished as follows:

Capsule usually wider than long. Sepals more than twice as long as the capsule, usually subtended by one or two sepal-like bractlets. Stems 2-4 dm. long, more laxly ascending, its leaves usually 1.5-2.5 cm. long. Plant usually less fleshy. South-western Georgia and northcentral Florida to Texas and Oklahoma.

G. ramosa drummondii.

Capsule as long or longer than wide. Sepals usually about twice as long as the capsule, subtended by one small bractlet or none. Stems 1-2 (-3) dm. tall, strictly erect, its leaves usually less than 1.5 cm. long. Plant more fleshy. South Carolina to Southern Florida, and, occasionally, westward to eastern Louisiana.

G. ramosa.

3. *Gratiola neglecta* Torr.

Gratiola neglecta Torr., Cat. Pl. N. Y. 89. 1819. "Within thirty miles of the City of New York." Probable type seen in Herb. of Columbia University at the New York Botanical Garden. For discussion see Torrey 19: 146. 1919.

Corolla with tube greenish-yellow, the lobes white, at times pinkish. Flowering from April to June, and soon ripening fruit.

Wet loam, frequently sandy, usually in deciduous woodland, through the Coastal Plain of Arkansas, Louisiana, and eastern Texas; more common in the upland of Arkansas and eastern Oklahoma. Ranges across the continent northward.

ARKANSAS. Jefferson: Jefferson Springs, Pennell 10673 (Y), 10674 (A, C, H, K, L, M, U, Y). Pope: Russellville, Pennell 10624 (M, Y). Pulaski: Little Rock, Hasse (Y).

OKLAHOMA. Rogers: Verdigris, Bush 410 (U).

LOUISIANA. Rapides: Alexandria, Hale (L). St. Landry: Ville Platte, Langlois (Y).

TEXAS. Bowie: Dalby, Milligan (U). Harris: Hockley, Thuron (U). Liberty: Dolen, Young (T).

4. *Gratiola gracilis* Benth.

Gratiola gracilis Benth., in DC. Prod. 10: 402. 1846. "In Texas prope Harrisburgh (Drummond! Coll. 3. n. 284) . . . (v. s.)". Type not verified, and my search for the plant at Harrisburgh in May, 1920, failed.

Gratiola torreyi Small, Fl. S. E. Un. St. 1066, 1338. 1903. "Type, Wright Mex. Bound. Surv., in Herb. C. U." Type collected on the "Colorado and Blanco Rivers, Texas," seen in the Herbarium of Columbia University at the New York Botanical Garden. Plant smaller and leaves narrower than described for *G. gracilis*. Although described as "corolla golden-yellow," the lobes as shown in the type were clearly white.

Apparently in the Coastal Plain of middle coastal Texas, extending to the base of, or entering along streams, the hills of the Edwards Plateau of central Texas. Little-known.

5. *Gratiola flava* Leavenworth, nom. nov.

Gratiola pusilla Torr.; Benth. in DC. Prod. 10: 402. 1846. "In campis humidis Texas! Arkansas! . . . (v. s. comm. a cl. A. Gray.)" Probably based on collections of Dr. Leavenworth. Not *G. pusilla* Willd., Sp. Pl. 1: 105. 1797.

The name "*Gratiola flava*" occurs with a specimen of Dr. Leavenworth's, labeled as from "prairies near the Sabine River, Texas," and which is in the Herbarium of the Academy of Natural Sciences of Philadelphia. Very probably this is an isotype of *G. pusilla* Torr., as specimens of the same collection are in the Herbarium of Columbia University.

Sandy prairies in and near the pinelands of southern Arkansas,

western Louisiana and eastern Texas. Little-known. Flowering in May and June, and soon ripening fruit.

ARKANSAS. Leavenworth (Y).

LOUISIANA. Hale (Y).

TEXAS. Waller: Hempstead, Hall 414 (A, U, Y).

6. *Gratiola virginiana* L.

Gratiola virginiana L., Sp. Pl. 17. 1753. "Habitat in Virginia." For discussion of the type of this see S. F. Blake in *Rhodora* 20: 65. 1918.

Corolla white, within with longitudinal purple lines, more pronounced on posterior side. Flowering from March to May and soon ripening fruit.

Wet loam, in shade, usually along streams, in the Coastal Plain of eastern Arkansas, Louisiana and eastern Texas. Ranges from New Jersey to Florida and Texas, inland in the Mississippi Valley to Illinois and Missouri.

ARKANSAS. Jefferson: Eggert (Y). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. "New Orleans," Drummond (Y).

TEXAS. Bowie: Texarkana, Letterman (Y). Harris: Houston, Biltm. hb. 1215a (U).

3. **SOPHRONANTHE** Benth.

Sophronanthe Benth.; Lindl., Nat. Syst. Bot. ed. ii. 445. 1836.

Type species, *S. hispida* Benth.

1. *Sophronanthe hispida* Benth.

Sophronanthe hispida Benth., l. c. 445. 1836. "The plant was gathered by Drummond at Apalachicola." Isotype, Drummond 20, seen in Herbarium of Columbia University at the New York Botanical Garden.

Corolla with tube externally yellowish-white, within and on lobes white. Flowering from May to September, and soon ripening fruit.

To be expected in the dry sandy long-leaf pineland, but specimens have been seen only from Cameron Parish, Louisiana. Ranges within this belt, from Southern Georgia and Florida westward to Louisiana.

LOUISIANA. Cameron: Cameron, Tracy 8710 (Y).

4. **HYDROTRIDA** Small.

Hydrotrida Small, Fl. Miami 165. 1913.

Type species, *Obolaria caroliniana* Walt.

1. **Hydrotrida caroliniana** (Walt.) Small.

Obolaria caroliniana Walt., Fl. Carol. 166. 1788. Type not verified, but description sufficiently distinctive. Doubtless from lower South Carolina, a district where the species now considered is frequent.

Hydrotrida caroliniana (Walt.) Small, l. c. 165. 1913.

Corolla uniformly sky-blue. Flowering from May to September and soon ripening fruit.

Aquatic in shallow water, sandy soil, edges of ponds and in small streams in long-leaf pineland of southern Louisiana. Ranges within this belt, from North Carolina to Florida and Louisiana.

LOUISIANA. Calcasieu: Lake Charles, Allison 209 (U, Y); Perkins, Pennell 10213 (Y). Rapides: Alexandria, Hale (C, U).

5. **BRAMIA** Lamarck.

Bramia Lam., Encyc. Meth., Bot. 1: 459. 1785.

Type species, *B. indica* Lam., of India.

1. **Bramia monnieri** (L.) Pennell.

Lysimachia monnieri L., Cent. Pl. 2: 9. 1756. "Habitat in America meridionali, Hallman." D. Z. Hallman sent to Linné specimens from Spain, so it would appear that the type of this was probably transmitted through him from some source in Spanish America.

Bramia monnieri (L.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 243. 1920.

Corolla, with tube yellowish within, elsewhere white or tinged with pink. Flowering from April to September, and soon ripening fruit.

Sandy shores, especially where subject to inundation, along the coast of Louisiana and Texas, common within tidewater, both where brackish and where fresh; also inland along streams, in central Texas to Burnet and Gillespie counties. From North Carolina southward through Tropical America. Also in the Old World Tropics.

LOUISIANA. Calcasieu: Lake Charles, Allison 62 (U). Jefferson: Gretna, Ball 363 (U, Y). Plaquemines: South Pass, Tracy & Lloyd 90 (U).

TEXAS. Bexar: (U). Brazoria: Columbia, Bush 1567 (U). San Antonio, Schulz 149. Burnet: Granite Mountain, Pennell 1046: (A, H, M, U, Y). Cameron: Rio Hondo, Chandler 7016 (U). Comal: New Braunfels, Lindheimer 1056 (A, T, U, Y). Galveston. Galveston, Ward (U, Y). Gillespie: Threadgill, Jermy 612 (U). Guadalupe: Seguin, Groth 182 (U). Harris: Hockley; Houston, Hall 415 (U). Nueces: Corpus Christi, Heller 1823 (A, U, Y). Travis: Barton Creek, Young (T).

6. **MACUILLAMIA** Rafinesque.*Macuillamia* Raf., Autik. Bot. 44. 1840.Type species, *Monniera rotundifolia* Michx.1. **Macuillamia rotundifolia** (Michx.) Raf.*Monniera rotundifolia* Michx., Fl. Bor. Am. 2: 22. 1803. Hab. in regione Illinoensi [A. Michaux]." Type not verified, but description sufficiently distinctive.*Macuillamia rotundifolia* (Michx.) Raf., l. c. 44. 1840.*Ranapalus rotundifolius* (Michx.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 242. 1920.

Corolla with tube yellow within, the lobes white. Flowering from June to October, and soon ripening fruit.

Aquatic in shallow mud-bottomed open ponds, through the upland of central Oklahoma and northern Texas, south to Travis County; also in bottom-lands of the Coastal Plain. Ranges from Indiana and Tennessee to North Dakota, eastern Colorado and central Texas.

ARKANSAS. St. Francis: Mud Lake, McAtee 1851 (U).

OKLAHOMA. Washington: Copan, Stevens 2082 (U).

LOUISIANA. Rapides: Alexandria, Hale (L, U, Y).

TEXAS. Dallas: Dallas, Reverchon (Y). Matagorda: Bay City, Fisher 166 (U). Randall: Paloduro Canyon,—(T). Tarrant: Polytechnic, Ruth 579 (Y). Travis: Austin, Tharp (T).

7. **HYDRANTHELIUM** Humboldt, Bonpland, and Kunth.*Hydranthelium* H. B. K., Nov. Gen. et Sp. 7: 202. 1825.Type species, *H. callitrichoides* H. B. K., of Venezuela.1. **Hydranthelium egense** Poepp.*Hydranthelium egense* Poepp., Nov. Gen. et Sp. 3: 75. t. 287. 1845. "Crescit in paludibus ad Ega in Brasilia boreali, Octobre lectum [Eduardus Poeppig in 1827-32]."There can be no doubt of the identity of the Louisiana aquatic with this species of Brazil. The exceedingly small flowers of this genus and the occurrence of the plants in river-sloughs, cause them to be little observed, and the species may be widely distributed through Tropical America. *H. egense* has likely been brought to Louisiana by bird-migrants.

Aquatic in sloughs in central Louisiana. Probably introduced from South America.

LOUISIANA. Rapides: Alexandria, Hale (Y).

8. **STEMODIA** Linné.*Stemodia* L., Syst. Nat. ed. X. 1118. 1759.Type species, *S. maritima* L., of Jamaica.

Corolla glabrous within on posterior side, hirsute within anteriorly. Bractlets lanceolate-linear, at least half the length of the sepals. Lower pedicels as long as or longer than the calyx. Herbage finely hispid-pubescent, slightly glandular. Stems erect, 1-6 dm. tall. *S. schottii*.

Corolla densely pubescent within on posterior side, pubescent with shorter hairs anteriorly. Bractlets subulate, less than half length of sepals. Pedicels all much shorter than the calyx. Herbage white-lanose, not glandular. Stems extensively repent. *S. tomentosa*.

1. **Stemodia schottii** Holz.

Stemodia schottii Holz., in Contrib. U. S. Nat. Herb. 1: 286. pl. 20. 1893. "Habitat, southern Texas, along the Rio Grande. Collected by Dr. Schott at Rio Grande, Texas, in 1853; and by G. C. Nealley, at Comstock, Valverde County, Texas, in 1889 (No. 305)." Type seen in United States National Herbarium.

Valverde County, Texas. Ranges from Texas to southern California, and south to Jalisco. Nearly related to the wide-spread Tropical American *S. durantifolia* (L.) Sw., but seeming to differ in its lower habit and longer pedicels. Needs further field study.

2. **Stemodia tomentosa** (Mill.) Greenm. & Thoms.

Erinus tomentosus Mill., Gard. Dict. ed. VIII, n. 2. 1768. "Sent . . . by the late Dr. Houstoun from La Vera Cruz." Description sufficiently distinctive.

Stemodia tomentosa (Mill.) Greenm. & Thoms., in Ann. Missouri Bot. Gard. 1: 409. 1915.

Recorded in Coulter's Botany of Western Texas under the later, but more appropriate, name, *Stemodia lanata* Ruiz & Pavon.

Sands of the seashore, extreme southern Texas. Ranges southward along the Gulf coast to Vera Cruz

TEXAS. Cameron: Brazos Santiago, Nealley 348 (U).

9. **ILYSANTHES** Rafinesque.

Ilysanthes Raf., Ann. Nat. 13. 1820.

Type species, *I. riparia* Raf., of the banks of the Ohio.

Pedicels relatively stout, at least in fruit shorter than the bracts. Leaves 1-3 cm. long, usually obviously narrowed at base. Sepals usually finely pubescent, usually about equaling the capsule.

I. dubia.

Pedicels filiform, longer than the bracts. Leaves .5-1.5 cm. long, rounded at base, or at least broadest much below the middle. Sepals glabrous or nearly so, shorter than the capsule.

I. inaequalis.

1. **Ilysanthes dubia** (L.) Barnhart.

Gratiola dubia L., Sp. Pl. 17. 1753. "Habitat in Virgianiae aquis . . . Gron. virg: 129". Type, Clayton 164, identified by Dr. B. L. Robinson in Rhodora 10: 67, 1907, as the species here considered.

Ilysanthes dubia (L.) Barnhart, in Bull. Torr. Bot. Club 26: 376. 1899.

Corolla pale lavender, deeper in color near margin of lobes, and within on the antero-lateral ridges with short yellow hairs. Flowering from May to September, and soon ripening fruit.

Swamp and stream margins, especially where shaded, loam soil; probably most prevalent in the upland of Arkansas and eastern Oklahoma, entering the Coastal Plain of Louisiana and north-eastern Texas, especially in bottom-lands. Ranges from New Brunswick and Ontario to Wisconsin, Kansas, Florida and Texas; also in the West Indies and South America.

ARKANSAS. Poinsett: Marked Tree, Bush 141 (U, Y).

OKLAHOMA. Ottawa: Miami, Stevens 2313 (U).

LOUISIANA. Morehouse: Mer Rouge, Bush 143 (Y). Rapides: Alexandria, Ball 473 (U, Y). West Carroll: —, Moseley (U).

TEXAS. Bowie: Texarkana, Heller 4176 p. p. (Y).

2. *Ilysanthes inaequalis* (Walt.) Pennell.

Gratiola inaequalis Walt., Fl. Carol. 61. 1788. Type not verified, but is doubtless from lower South Carolina where the plant here considered is frequent.

Gratiola brevifolia Raf., Atl. Journ. 1: 176. 1833. "Texas [or] Arkansas, in my herbarium." Type not known to exist. The small incurved purplish corolla would indicate this genus, and the short ovate leaves with pedicels longer than these, this species. Evidently but a scrap of a plant, or the plant would not have been described as simple.

Ilysanthes inaequalis (Walt.) Pennell, in Torrey 19: 149. 1919.

Corolla as in *I. dubia*. Flowering from April to September, and soon ripening fruit.

Swamps and pond-margins, in loam or more usually sandy soil, frequently in open situations about pineland pools, through the Coastal Plain of Arkansas, Louisiana and eastern Texas; inland in eastern Oklahoma and central Texas, to the Burnet Metamorphic Region and even to Tom Green County. Ranges from Massachusetts to Florida and Texas, inland westward to Missouri and Colorado; also in the Pacific Coast states, Mexico, West Indies, Central and South America. Intergrades with *Ilysanthes dubia*.

ARKANSAS. Benton —, Plank (Y). Hempstead: Fulton, Bush 1036 (U). Jefferson: —, Eggert (Y).

OKLAHOMA. Payne: Perkins, Waugh 26 (U); Stillwater. Washington: Capon, Stevens 2115½ (U).

LOUISIANA. Calcasieu: Lake Charles, Plank 41 (U).

TEXAS. Austin: Kenney, Pennell 10310 (A, T, Y); Sealy, Pennell 10296 (H, U, Y); Wallis, Pennell 10265 (M, Y). Bowie: Texarkana, Heller 4176 p. p. (U). Burnet: Fairland, Pennell 10476

(C, L, Y). Harris: Hockley, Houston; Hall 416 (U, Y). Lee: Giddings, Plank (Y). Madison: —, Dixon (Y). Tarrant: Handley, Ruth 503 (U). Tom Green: —, Tweedy (Y).

10. **GLOBIFERA** J. F. Gmelin.

Globifera J. F. Gmel., Syst. 2: 32. 1791.

Type species, *Anonymos umbrosa* Walt.

1. **Globifera umbrosa** (Walt.) J. F. Gmel.

Anonymos umbrosa Walt., Fl. Carol. 63. 1788. Type, probably from lower South Carolina, identified by Dr. S. F. Blake, in *Rhodora* 17: 131. 1915, as the species here considered.

Globifera umbrosa (Walt.) J. F. Gmel. l. c. 32. 1791.

Corolla uniformly dull-white. Flowering from May to October and soon ripening fruit.

Wet loam or in shallow water, in woodland, especially in river-bottoms, through the Coastal Plain of Louisiana and southeastern Texas. Ranges from North Carolina to Florida and eastern Texas; also in eastern Mexico and the West Indies.

LOUISIANA. Calcasieu: Perkins, Pennell 10217 (A, C, H, K, L, M, T, U, Y). Rapides: Alexandria, Ball 466 (U, Y).

TEXAS. Harris: Sheldon, Reverchon 3936 (U). Walker: Huntsville, Dixon 368 (Y).

11. **LEUCOSPORA** Nuttall.

Leucospora Nutt., in Journ. Acad. Nat. Sci. Phila. 7: 87. 1834.

Type species, *Capraria multifida* Michx.

1. **Leucospora multifida** (Michx.) Nutt.

Capraria multifida Michx., Fl. Bor. Am. 2: 22. pl. 35. 1805. "Hab. in ripis arenosis fluminum amniculorumque, in Tenasseé et Illinoensi regione."

Type not verified, but description and plate certainly of species here considered.

Leucospora multifida (Michx.) Nutt., l. c. 87. 1834.

Corolla pale-lavender, deeper on lobes, and lined with deeper lavender; tube within at base greenish-yellow, then yellow on the anterior side, and toward mouth with a purplish ring; white at base of the lavender anterior lobes. Flowering from May to November, and soon ripening fruit.

Sandy or loam banks of brooks or rivers, in open meadows or along shores, through the upland of Arkansas and Oklahoma south to central Texas, entering the Coastal Plain along river-banks and reaching nearly to the sea. Ranges from southwestern Ontario to Kansas, south to Alabama and Texas.

ARKANSAS. Benton: —, Plank (Y). Pulaski: Little Rock,

Hasse (Y). Sebastian: Fort Smith, Bigelow (U).

OKLAHOMA. Comanche: Cache, Stevens 1320 (U). Kay: Tonkawa, Stevens 1876 (U). Payne: Stillwater, Waugh (U). Woods: Waynoka, Stevens 1769 (U).

LOUISIANA. Rapides: Alexandria, Ball 491 (U, Y).

TEXAS. Bexar: Comanche Spring, Lindheimer 1048 (A, T, U, Y). Bowie: Texarkana, Heller 4255 (A, U, Y). Comal: New Braunfels, Lindheimer 1049 (A, T, U, Y). Dallas: Dallas, Reverchon (Y). Gillespie: Fredericksburg, Jermy 680 (U). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Heller 1926 (A, U, Y). Matagorda: Bay City, Fisher 158 (U). Tarrant: Fort Worth, Ruth 102 (U, Y). Travis: Shoal Creek, Young (T).

12. **MIMULUS** Linné.

Mimulus L., Sp. Pl. 634. 1753.

Type species, *M. ringens* L.

Corolla yellow. Calyx strongly oblique, its posterior lobe longest, the lateral usually blunt. Capsule dehiscent laterally, apex persistent and valves permanently attached to septum. Seeds ellipsoid-orbicular. Leaf-blades broad-ovate, palmately veined. Stems repent-ascending. (*I. Simiolus*.) 1. *M. glabratus*.

Corolla lavender-violet. Calyx-lobes equal, all acuminate. Capsule dehiscent laterally from very apex, and valves splitting from septum. Seeds oblong. Leaf-blades lanceolate to ovate, pinnately veined. Stems erect. (*II. Eumimulus*.)

Leaf-blades ovate, petioled. Angles of stem slightly winged. Pedicels stout, in fruit 5-10 mm. long. Calyx-lobes setaceous-tipped, 1-2 mm. long. Corolla 35 mm. long. Seeds pale-yellow. 2. *M. alatus*.

Leaf-blades lanceolate, clasping. Angles of stem not winged. Pedicels slender, in fruit 30-60 mm. long. Calyx-lobes lanceolate, 3-5 mm. long. Corolla 30 mm. long. Seeds brownish.

3. *M. ringens*.

1. **Mimulus glabratus** H. B. K.

Mimulus glabratus H.B.K., Nov. Gen. et. Sp. 2: 370. 1817. "Crescit prope Moran Mexicanorum, alt. 1330 hex." Type not verified, but description evidently of plant here considered.

Mimulus Jamesii texensis A. Gray, Syn. Fl. N. Am. 2. 1: 277. 1878. Texas, Wright, Lindheimer, etc. Probably in drier soils." Probable isotype seen in Herbarium of Columbia University at the New York Botanical Garden.

Very variable in size in all its parts, the larger form being *M. jamesii texensis* A. Gray or *M. inamoenus* Greene from Trans-Pecos Texas.

Corolla lemon-yellow, within throat on anterior side golden and

spotted with many red-brown spots. Flowering from April to August, and soon ripening fruit.

About springheads and ponds, and along streams, plains of central and western Oklahoma, south to the hills of central Texas (Burnet region and Edwards Plateau). Wide-ranging through America from North Dakota and Colorado south to Bolivia.

OKLAHOMA. Harper: Doby Springs, Stevens 318 (U). Love: Thackerville, Stevens 63 (U). Major: Cleo, Stevens 782 (U). Woods: Alva, Stevens 3910 (U).

TEXAS. Burnet: Granite Mountain, Fennell 10459 (C, H, Y). Comal: New Braunfels, Lindheimer 1057 (A, T, Y). Gillespie: Crab-Apple, Jermy 164 (U). San Saba: San Saba, Reverchon 1341 (U, Y). Travis: Austin, Pennell 10444 (A, L, M, U, Y); Bee Creek; Mt. Bonnell.

2. *Mimulus alatus* Ait.

Mimulus alatus Ait., Hort. Kew. 2: 361. 1789. "Nat. of North America. Introd. 1783, by Mr. William Malcolm." Type not verified, but description sufficiently distinctive.

Corolla pinkish-lavender, within throat essentially as in *M. ringens* but the spots are smaller and the color fainter. Flowering from July to August and probably ripening fruit in September and October.

Wet woods and shaded river-bottoms, loam soil, hills of eastern Oklahoma, perhaps near the Red River in Louisiana. Ranges from Connecticut to Ontario and Kansas, south to Florida, Mississippi and Oklahoma.

OKLAHOMA. Osage: Pawhuska, Stevens 2003½ (U). Pittsburg: near Gain's Creek, Bigelow (Y).

LOUISIANA. (?) On Red River, Hale (L).

3. *Mimulus ringens* L.

Mimulus ringens L., Sp. Pl. 634. 1753. "Habitat in Virginia, Canada, . . . Hort. ups. 176 t. 2." In Hortus Upsalensis 176, pl. 1. 1748.

Linné described and figured our plant.

Mimulus pteropus Raf., Fl. Ludov. 44. 1817. "*M. alatus* Rob. pl. 396." This reference is to C. C. Robin, Voy. Louisiane 3: 396, 1807, in which is given a fuller description. The leaves sessile and semi-amplexicaul are distinctive. Probably from the present state of Louisiana.

I know of no other record than Robin's of the occurrence of this species in the West Gulf States. But from its wide general range, Nova Scotia to Minnesota south to Florida and Kansas, it should be expected in Arkansas and eastern Oklahoma.

13. *VERBASCUM* Linné.

Verbascum L., Sp. Pl. 177. 1753.

Type species, *V. thapsus* L., of Europe.

1. *Verbascum thapsus* L.

Old fields, roadsides and thickets. Seen from Louisiana and eastern Texas, probably frequent throughout our area. Naturalized from Eurasia.

14. *LEUCOPHYLLUM* Humboldt and Bonpland.

Leucophyllum H. & B., Pl. Aequin. 2: 95. 1809.

Type species, *L. ambiguum* H. & B., of Mexico.

1. *Leucophyllum texanum* Benth.

Leucophyllum texanum Benth. in DC. Prod. 10: 344. 1846. "Juxta Laredo prov. Texas (Berlandier!) . . . (v. s. comm. a cl. Hook.)" Probable isotype, Berlandier 2070 (labeled "2070-660"), collected "cerca Laredo, Junio, 1829," seen in Herb. of Columbia University at the New York Botanical Garden.

Corolla 18-20 cm. long, larger than, and leaves not semi-petioled as are those of the other species, *L. ambiguum* H. & B. of central Mexico and *L. minus* Gray of Trans-Pecos Texas and Chihuahua. Also the leaves and branchlets are in *ambiguum* more densely tomentose with much more widely branching hairs, in *minus* closely stellate pubescent with scarcely stalked hairs. *L. minus* is to be looked for in the western Edwards Plateau.

Corolla "rose-colored with lavender tinge," on anterior side "from base to mouth having a white ground with orange-colored splotches in four or five lines." Flowering, southward nearly throughout year, northward from June to September, and soon ripening fruit.

Hills and plains, limestone bluffs, from Austin, Travis and Gillespie counties, Texas, southward, increasing and becoming a characteristic chaparral shrub near the Rio Grande. Ranges southward through Nuevo Leon and Coahuila.

TEXAS. Austin: San Felipe, Mexican Boundary Survey (Y). Cameron: Rio Hondo, Chandler 7023 (Y). Duval: San Diego, Croft 50 (Y). Gillespie: Threadgill, Jermy 446 (U). Hidalgo: Hidalgo, Pringle 1957 (A, Y); Mission. Nueces: Corpus Christi, Heller (Y). Travis: Austin, Pennell 10450 (Y), Tharp (T, Y). Uvalde: Sabinal, Reverchon 1572 (P, U, Y); Uvalde. Webb: Laredo, Berlandier 2070 (Y).

15. *PENSTEMON* (Mitchell) Schmidel.

Penstemon Schmidel, Icon. Pl. 2. 1762.

Type species, *Chelone pentstemon* L., of Virginia.

- A. Anther-cells divaricate, opening throughout. Leaves membranous or somewhat fleshy, the lower petioled (in *P. ambiguus* linear), and all the cauline leaves deciduous.

- B. Corolla scarlet, slightly fleshy, glabrous externally and within, 30-35 mm. long, the tube gradually expanding distally. Sterile filament glabrous. Upper leaves widely connate. Plant glaucous, forming winter rosettes, the stems strictly annual. (*Elmigeria*.) I. CENTRANTHIFOLII. 1. *P. murrayanus*.
- B B. Corolla purple, red, blue, or white, membranous, the throat usually more abruptly expanding. Leaves all distinct. (*Eupensiemon*.)
- C. Leaf-blades broadly-linear to ovate, at least 2 mm. wide. Corolla-throat straight or upcurved, relatively inflated. Sterile filament bearded. Plants forming winter rosettes, the stems strictly annual.
- D. Corolla-throat inflated-rounded anteriorly, within glandular-puberulent or glabrous. Seeds 2-3 mm. long.
- E. Corolla glabrous externally and internally. Anther-cells oblong. Sterile filament enlarged distally. Leaves entire, relatively thick, somewhat fleshy. Plants glaucous. II. COERULEI.
- Corolla 40-45 mm. long, the tube much inflated, the lobes slightly spreading. Sterile filament closely short-bearded near the apex. Capsule 20-25 mm. long. Bracts obtuse to acute.
2. *P. grandiflorus*.
- Corolla 15-20 mm. long, lined with deeper color, the tube little inflated, the lobes strongly spreading. Sterile filament relatively densely bearded distally. Capsule 10-16 mm. long. Bracts acuminate.
- Corolla pale-lavender, its lobes 3-4 mm. long. Sterile filament slightly widening and moderately bearded distally with dull-yellowish hairs. Capsule 14-16 mm. long. Bracts broad, mostly surrounding the fruits, becoming conspicuously reticulate. Foliage dull-glaucous.
3. *P. buckleyi*.
- Corolla blue, its lobes 4-5 mm. long. Bracts not becoming reticulate. Foliage pale-glaucous.
- Sepals 6-7 mm. long, more attenuate. Sterile filament slightly enlarging and moderately bearded distally with short orange-yellow hairs. Capsule 13-15 mm. long. Bracts, except the uppermost, longer than the pedicels. Leaf-blades linear to lanceolate, acuminate, longer than the internodes.
4. *P. angustifolius*.
- Sepals 5-6 mm. long, acuminate. Sterile filament more enlarged and usually more densely bearded, the beard of golden-yellow hairs. Capsule 10-12 mm. long. Bracts shorter than the pedicels, often

only rudimentary. Leaf-blades ovate, obtuse to acutish, mostly shorter than the internodes.

5. *P. fendleri*.

- EE. Corolla glandular puberulent externally and internally. Anther-cells as wide as long. Sterile filament slender, not or but slightly enlarged distally. Leaves usually serrate, thinner, firm, membranous. Plants not glaucous. III. ALBIDI.

Corolla 15-20-25 mm. long, white or violet-tinged, its posterior lobes united less than half their length. Anthers dark violet-gray. Capsule 10-15 mm. long. Stem-leaves broadly linear to lanceolate, entire or serrate.

Leaves permanently more or less canescent, lanceolate, those of the basal tufts narrowly ovate. Capsule ellipsoid-ovate to ovate in outline, 5-7 mm. wide.

6. *P. albidus*.

Leaves glabrous (except for minute line along midrib above), broadly linear, those of the basal tufts broadly or spatulate-linear. Capsule globose-ovate in outline, 7-8 mm. wide.

7. *P. guadalupensis*.

Corolla 25-50 mm. long, violet-purple to white, its posterior lobes united more than half their length. Anthers gray. Capsule 15-20 mm. long. Stem-leaves lanceolate to ovate, mostly serrate.

Corolla 25-40 mm. long, its throat gradually expanding from the tube, moderately inflated and not narrowing to orifice. Sepals acuminate.

8. *P. triflorus*.

Corolla 40-50 mm. long, its throat abruptly expanding from the tube, strongly inflated and narrowing to orifice. Sepals acutish to slightly acuminate.

Corolla pale-purple, more widely inflated, usually obscurely glandular within. Foliage pale-green.

9. *P. cobaea*.

Corolla deep-purple, less widely inflated, more evidently glandular within. Foliage deeper green.

9a. *P. cobaea purpureus*.

- DD. Corolla-throat more or less flattened, two-ridged within, anteriorly (scarcely so in *P. tubiflorus*). Seeds .8-1 mm. long.

E. Corolla white, not lined, glandular-puberulent within on all sides; the throat slightly inflated and scarcely or not two-ridged within, the lobes widely spreading. Stem and leaves glabrous, the latter entire or very nearly so. IV. TUBIFLORI.

10. *P. tubiflorus*.

EE. Corolla white or pink, usually with lines of deeper color, somewhat pubescent with glandless hairs within over bases of anterior lobes; the throat inflated and two-ridged within anteriorly. Leaves more or less serrate. V. GRACILES.

Corolla with throat much inflated and only slightly two-ridged within anteriorly. Sepals acuminate, more than one half length of capsule. Sterile filament moderately bearded.

Anthers barbate. Corolla 25-35 mm. long, more strongly inflated, white or slightly tinged or lined with purple. Stem glabrous or nearly so, semi-shining. 11. *P. digitalis*.

Anthers glabrous. Corolla smaller, moderately inflated, more or less violet-purple. Stem finely pubescent to glabrous, relatively dull.

Corolla 20-25 mm. long, usually light violet-purple. Inflorescence narrower than long, in fruit 2-6 cm. wide, its cyme-branches of but two or three nodes. Stem-leaves mostly oblong-lanceolate, relatively less expanded at base, less serrate.

12. *P. pentstemon*.

Corolla 15-20 mm. long, violet-pink, paler within. Inflorescence in fruit usually 6-12 cm. wide, its cyme-branches of repeated nodes. Stem-leaves usually much smaller, often somewhat expanded at base, more sharply serrate.

13. *P. tenuis*.

Corolla with throat narrow, strongly two-ridged within anteriorly. Sepals acute or triangular-acuminate, less than or nearly one half length of mature capsule.

Corolla 15-17 mm. long, white, its throat about as long as the tube, the orifice not closed by the anterior lip. Sterile filament moderately bearded. Leaves below inflorescence relatively well-developed, so stem conspicuously leafy.

Free portions of posterior lobes of corolla upcurved. Inflorescence 4-7 cm. wide. Stems puberulent or pubescent. Basal leaves 7-10 cm. long, obtuse to acute, crenate-serrate, the stem-leaves obtusish to acuminate, all puberulent. Plants forming small clumps of few stems.

Stem grayish-puberulent.

14. *P. arkansanus*.

Stem pubescent. Stem-leaves broader, nearly ovate.

14a. *P. arkansanus pubescens*.

Free portions of posterior lobes of corolla upcurving-reflexed. Inflorescence 6-12 cm. wide. Stems obscurely puberulent. Basal leaves 12-18 cm. long, acuminate, sharply serrate, the stem-leaves acuminate-attenuate, all glabrous. Plants forming large clumps, of very many stems.

15. *P. multicaulis*.

Corolla 20-30 mm. long, pinkish- or purplish-white, its throat longer than the tube, the orifice somewhat-closed by the anterior lip which upcurves as an arc. Sterile filament densely bearded. Leaves just below inflorescence tending to be much reduced, so stem less "leafy."

16. *P. pauciflorus*.

CC. Leaf-blades filiform, less than 1 mm. wide. Corolla 15-20 mm. long, its throat decurved, narrow, not inflated. Sterile filament glabrous. Plant not forming winter rosettes, the bases of the stems perennial. VI. AMBIGUI.

17. *P. ambiguus*.

AA. Anther-cells pendulous (so anthers tend to be horseshoe-shaped), opening partially by proximal slits (which extend over two thirds length of sac). Leaves coriaceous, all sessile, and the lower cauline leaves persistent on the perennial bases of the stems. Corolla deep-carmine, its posterior lobes projecting, the anterior recurved. (*Saccanthera*.) VII. BACCHARIFOLII.

18. *P. baccharifolius*.

1. *Penstemon murrayanus* Hook.

Penstemon murrayanus Hook., in Bot. Mag. 63: pl. 3472. 1836. "A native of San Felipe, in Texas: discovered by Mr. Drummond, in 1834." Grown in the Glasgow Botanic Garden. Drummond, Coll. II, 292, from which collection the seeds for culture were likely obtained, seen in Herb. Columbia University at the New York Botanical Garden.

Sand, open woods or prairies, through the short-leaf pineland of eastern Texas, westward locally in the cross-timbers (oak-woods) and coast prairie; from southwestern Arkansas to San Augustine, Refugio and Milam counties, Texas. Flowering from late April to mid-June.

ARKANSAS. —: Fort Towson, Leavenworth (A, Y).

TEXAS. Ellis: Ennis, Hogan (U). Gregg: Gladewater, Reverchon 2542 (M, U). Houston: Grapeland, Tharp (T, Y). Milam: Milano, E. J. Palmer 11661 (M). Refugio: Refugio, E. J. Palmer 9119 (M). San Augustine: San Augustine, E. J. Palmer 9512 (M). Smith: Swan, Reverchon 3221 (M, U, Y). Waller: Hempstead, Hall 409 (U, Y).

2. *Penstemon grandiflorus* Nutt.

Penstemon grandiflorus Nutt. in Fraser's Cat. 1813. "It was first met with near the confluence of the River Platte [with the Missouri] from whence it continues to the Andes [Nuttall]." Probable isotype seen in Herbarium of the Academy of Natural Sciences of Philadelphia.

Sandy prairies and open woodland, western Oklahoma, south to central Texas; Lower Sonoran Zone (at altitudes of 1,500 to 2,000 feet). Ranges through the Plains from Wisconsin and North Dakota to Wyoming and Texas. Flowering in late April and May.

OKLAHOMA. Probably on False Washita, between Fort Cobb and Fort Arbuckle, *E. Palmer* 226 (U, Y).

TEXAS. Callahan: Baird (sandy woods, west of B), Reverchon 1342 (M). Gillespie: Sandy Creek, Jermy 280 (M).

3. *Penstemon buckleyi* Pennell, sp. nov.

Penstemon amplexicaulis Buckley, in Proc. Acad. Nat. Sci. Phila. 1861: 461. 1862. "About 60 miles N. E. of Camp Colorado [Texas, *S. B. Buckley*] June [1861]." Camp Colorado, as I am informed by Mr. B. C. Tharp of the University of Texas, "was in Coleman County about fifteen miles northwest of the present town of Coleman." "About 60 miles northeast of" this point would reach Sandy Creek in Stephens County, and it was doubtless in a sand-region that Buckley found his plant. His description must be modified to denote a plant with sterile filament moderately bearded [not "glabro"] and with anthers glabrous [not "piloso-lanatis"]. Type seen in the Herb. of the Academy of Natural Sciences of Philadelphia, and these discrepancies verified and corrected. Not *P. amplexicaulis* Moench, Meth. 442. 1794.

Corolla pale-lavender, with lavender-violet lines within on anterior side. Flowering in May and early June.

Dry sandy soil, sand-hills of western Oklahoma and northwestern Texas; Lower Sonoran Zone (at altitudes of 1,700 to 2,400 feet). Ranges from southwestern Kansas to Taylor, and Ward counties, Texas.

OKLAHOMA. Beckham: Sayre, Pennell 10553 (M, Y), 10560 (A, C, H, J, K, L, M, O, P, S, T, U, Y), 10565 (U, Y). Woodward: Woodward, Eggert (M).

TEXAS. Hemphill: Canadian, Eggert (M), *E. J. Palmer* 14121 (M). (?) Stephens: —, Buckley (A). Taylor: Abilene, Eggert (M). Ward: Monahans, Clawson 13907 (U). Wheeler: (observed by Pennell).

4. *Penstemon angustifolius* Nutt.

Penstemon angustifolius Nutt. [in Fraser's Cat. 1813, nomen nudum;] Pursh, Fl. Am. Sept. 738. 1814. "In upper Louisiana, Bradbury. . . v.s. in herb. Bradbury." According to Bradbury (Travels, 318) this was collected "near the Mintaree village," in what is now North Dakota. Isotype; collected by Bradbury in "Louisiana," seen in Herb. Academy of Natural Sciences.

Penstemon coeruleus Nutt., Gen. Pl. 2: 52. 1818. "Hab. on the plains of the Missouri, near Fort Mandan and the Indian towns," North Dakota.

Our species would be *P. angustifolius caudatus* (Heller) Rydb., but that seems to be too inconstantly distinguishable to be considered as more than a form.⁶

Corolla coerulean-blue, with violet-pink lines within on anterior side. Flowering in May.

Sandy prairies, extreme northwestern ("Panhandle" region of) Oklahoma; Upper Sonoran Zone (at altitudes above 3,000 feet). Ranges through the High Plains from North Dakota and eastern Wyoming to northwestern Oklahoma and northern New Mexico.

OKLAHOMA. Beaver: Knowles, Stevens 323 (M, U). Cimarron: Doby, Stevens 508 (M, U).

5. *Penstemon fendleri* Torr. & Gray.

Penstemon fendleri T. & G., in Pacific Rail. Rep. 2: 4: 168. pl. 5. 1855. On "the Pecos and Llano Estacado [Texas, Dr. W. L. Diffenderfer on Pope's Expedition]." Type not seen, but description and illustration distinctive.

Corolla blue, pinkish on tube externally, with sharply defined violet-pink lines internally on both posterior and anterior lobes. Flowering in April and May.

Sandy or gravelly loam, frequently over limestone, on plains or bluffs, most common on the Staked Plains of northwestern Texas, entering extreme western Oklahoma, and crossing the escarpment southward to Menard and Tom Green Counties, Texas; chiefly Upper Sonoran Zone (at altitudes above 1,600 feet). Also in eastern New Mexico.

OKLAHOMA. Beaver: —, Stevens 352 (M, U).

TEXAS. Fisher: Grady, Shepherd (U). Garza: Post, Pennell 10533 (M, T, Y). Hale: Hale Center, — (T). Hall: Estelline, Reverchon (M). Martin: Stanton, Eggert (M). Menard: Menard, E. J. Palmer 11881 (M). Mitchell: Colorado, E. J. Palmer 13796 (M). Nolan: Sweetwater, E. J. Palmer 13736 (M). Potter: Ady, Pennell 10547 (A, M, T, U, Y). Randall: Canyon, Pennell 10540 (Y), 10540 (C, H, O, P, U, Y). Runnels: Ballinger, Pennell 10509 (T, Y). Swisher: Tulia, Pennell 10538 (A, C, H, J, J, L, M, O, S, T, U, Y). Tom Green: San Angelo, Pennell 10486 (A, C, H, K, M, T, U, Y).

6. *Penstemon albidus* Nutt.

Penstemon albidus Nutt., Gen. Pl. N. Am. 2: 53. 1818. "Hab. On the plains of the Missouri, common, from the confluence of the River Platte to the Mountains." Type seen in Herb. Academy of Natural Sciences of Philadelphia.

⁶ See discussion in Contrib. U. S. Nat. Herb. 20: 362. 1920.

Corolla violet-white, with many fine violet lines within throat on anterior side. Flowering from early May to early June.

Sandy or gravelly loam (frequently calcareous), on bluffs, low hills or prairies, western Oklahoma and northwestern Texas; chiefly Upper Sonoran Zone (at altitudes above 1,800 feet). Ranges through the High Plains from Manitoba and Montana to northwestern Texas.

OKLAHOMA. Beaver: Stevens 353 (M, U). (Beckham: observed by Pennell). Harper: Buffalo, Stevens 304 (M, U). Woodward: Woodward, Eggert (M).

TEXAS. Armstrong: Gamble's Ranch, E. J. Palmer 13906 (M). Garza: Post, Pennell 10530 (A, C, H, J, K, L, M, S, T, U, Y). Potter: Ady, Pennell 10549 (A, O, T, Y), Amarillo. Randall: Canyon, Pennell 10545 (C, H, M, P, T, U, Y).

7. *Penstemon guadalupensis* Heller.

Penstemon guadalupensis Heller, in Contrib. Herb. Franklin & Marshall Coll. 1: 92. pl. 7. 1895. "Very plentiful in dry, stony ground along the Guadalupe and Town Creek [near Kerrville, Texas], altitude 1600-1650 feet, April 19, [1894, A. A. Heller] 1609." Isotype seen in herbarium of Academy of Natural Sciences, etc.

"Corolla white or sometimes faintly tinged with purple." Flowering in April and May.

Sandy, gravelly or rocky open loam or clay, probably calcareous, Edwards Plateau, Concho and Lampasas counties; Lower Sonoran Zone (at altitudes from 1,300 to 2,200 feet). From Howard and Comanche to Kerr Counties, central Texas.

TEXAS. Brown: —, Reverchon 698 (M, U). Comanche: Comanche, Eggert (M). Gillespie: Fredericksburg, Bray 291 (T, U); Pedernales. Howard: Big Spring, Eggert (M). Kerr: Kerrville, Heller 1609 (A, M, U, Y). Nolan: Sweetwater, E. J. Palmer 13735 (M).

8. *Penstemon triflorus* Heller.

Penstemon triflorus Heller, in Contrib. Herb. Franklin and Marshall Coll. 1: 92. pl. 8. 1895. "Found only along the summit of one hill northeast of Kerrville [Texas], altitude 2000 feet . . . April 26 [1894], [A. A. Heller] (1654)." Isotypes seen in the herbaria of the Academy of Natural Sciences, etc.

Penstemon helleri Small, in Bull. Torr. Bot. Club 25: 471. 1898. "These specimens [Heller 1610] form the type . . . The original specimens are from Kerrville, Kerry County, Texas, collected in April and June, 1894." Type collected April 19, 1894, seen in the Herbarium of Columbia University at the New York Botanical Garden.

Plants very variable, apparently tending to two types, which are

predominantly plants of open or of shade. Both however, are frequently intermixed. One has corolla white or pale-pink, with relatively wider throat, the pedicels and peduncles shorter so that the thyrsus is more congested, and the leaves broader; this, the prevalent form, is the plant called by Heller *P. cobaea* and by Small *P. helleri*. The other has corolla darker, frequently bright pink-red, with narrower throat more glandular within, the peduncles and often fewer pedicels longer so that the thyrsus is more lax, and the leaves frequently narrower; this would be typical *P. triflorus*. In both the corolla has conspicuous deeper pink lines, especially on the anterior side. However, field-study convinces me that no real distinction of these trends can be made. All are well shown in my series from Kerrville, Texas. Flowering from March to May.

Thin calcareous loam, gravelly or rocky places, common on the hills of the Edwards Plateau, less frequent in the Lampasas and Concho countries; lower Sonoran Zone (at altitudes from 500 to 2,000 feet). From Lampasas and Tom Green to Bexar and Valverde Counties, central Texas.

TEXAS. Bexar: Beckmann, Pennell 10407 (T, Y); Camp Stanley Inc., Pennell 10409 (Y). Burnet: Marble Falls, Bray 109 (Y). Cooleman: Talpa, Pennell 10515 (Y). Comal: Bracken, Groth 23 (U). Crockett: Ozona to Devils River, Hanson 516⁷ (U, Y). Gillespie: Half-Moon Mt., Jermy 830 (M). Kendall: Boerne, Pennell 10415 (O, Y). Kerr: Kerrville, Heller 1610 (A, M, U, Y), 1654 (A, U, Y), Pennell 10377 (A, H, M, U, Y), 10380 (C, J, L, Y), 10382 (Y), 10397 (Y) 10398 (Y), 10399 (Y), 10400 (K, Y), 10402 (T, Y); Lacey's Ranch; Turtle Creek. Menard, Menard, E. J. Palmer 11865 (M). Real: Leahey, Lea (U) Tom Green: San Angelo, Pennell 10500 (A, C, H, M, T, U, Y). Travis: Glen Rose, Hill (U). Uvalde: Con Can, Sabinal, E. J. Palmer 10221 (Y).

9. *Penstemon cobaea* Nutt.

Penstemon cobaea Nutt., in Trans. Am. Phil. Soc. II. 5: 182. 1837. "Hab. In the sterile and denudated portions of the prairies of Red River [Arkansas Territory], in calcareous soil." Type seen in Herb. Academy of Natural Sciences of Philadelphia.

Corolla white or pale violet-purple, irregularly lined with violet; probably frequently somewhat darker, as the type is described as "bluish-purple." Flowering in April and May.

⁷ Corolla also with short hairs on the anterior side.

Black or red loam, usually calcareous, central and western prairies of Oklahoma, on Abilene and Lampasas plains, Grand and especially the Black Prairie, south to Bexar County, central Texas; also in post-oak woods eastward in Waller County; Austroriparian and Lower Sonoran Zones (at altitudes of 300 to 2,000 feet). Central Plains of Oklahoma and Texas, south to Bexar County. Ranges north to Kansas, and, including the following variety, into the Ozark Mountains of southern Missouri and Arkansas.

OKLAHOMA. Cleveland: Norman, Emig 485 (M). Custer: Weatherford, Pennell 10572 (A, C, H, J, K, L, M, O, P, S, T, U, Y). Woods: Cora, Stevens 539 (M, U).

TEXAS. Bexar: San Antonio, Thurber (Y). Comal: New Braunfels, Pilsbry (A). Comanche: Comanche, Eggert (M). Dallas: Dallas, Pennell 5402 (P, Y). Grayson: Denison, Letterman (M); Sherman. Hays: San Marcos, Stanfield (Y). Hood: Granbury, Eggert (M). Kaufman: Terrell, Tyler (U). McLennan: Waco, Griffith (Y). Medina: Hondo, Pilsbry (A). San Augustine: San Augustine, Leavenworth (A). Shackelford:—, Holstein. Tarrant: Fort Worth, Ruth 101 (M, U, Y). Taylor: Buffalo Gap, Havard (U). Travis: Austin, Pennell 10448 (U, Y). Waller: Hempstead Hall 408 (M U Y). Wichita: Burkburnett Tharp 522 (Y).

9a. *Penstemon cobaea purpureus* Pennell, var. nov.

Corolla 38–43 mm. long, less inflated, violet-purple and with dark violet lines; evidently glandular-pubescent within. Plant 10–12 dm. tall. Leaves usually longer, 10–15 cm. long, dark green.

Type, limestone cliffs, Penters Bluff, Izard Co., Arkansas, collected in flower June 1, 1920, F. W. Pennell 10681, in the Herbarium of the New York Botanical Garden.

Here considered as a geographic variety of the prairie species, *Penstemon cobaea*, but further field-study is needed to decide their mutual status. A strikingly distinct plant, when contrasted alive with the paler-flowered species, but specimens of the latter show great range of variation in most features. Flowering in May and June.

Rocky calcareous barrens and cliffs, Ozark Mountains of northern Arkansas and southern Missouri.

ARKANSAS. Izard: Penters Bluff, Pennell 10681 (A, C, H, K, L, M, O, T, U, Y). Marion: Cotter, E. J. Palmer 14320 (M).

10. *Penstemon tubiflorus* Nutt.

Penstemon tubiflorus Nutt., in Trans. Am. Phil. Soc. II. 5: 181. 1837. "Hab. In wettest prairies, from Forth Smith to Red River [Arkansas Territory. T. Nuttall]." Type seen in Herb. of the Academy of Natural Sciences of Philadelphia. Description of corolla as villose within is difficult to account for, otherwise our plant is certainly described.

Corolla white throughout. Flowering in late May and early June.

Sandy or light loam, deciduous or mixed woodland in the Ozark-Ouachita Mountains and hills of Arkansas and eastern Oklahoma, and on prairies in eastern Oklahoma. The plants seen from the Ozarks of Arkansas have habitually a laxer thyrsus and slightly smaller corollas than have those from the prairies and woods of Oklahoma. Also in Ozarks of southern Missouri.

ARKANSAS. Madison: Pettigrew, Howell 671 (U). Pope: Russellville, Pennell 10628 (H, M, Y). Pulaski: Little Rock, Pennell 10643 (A, C, H, J, K, L, M, O, P, S, T, U, Y). Sebastian: Fort Smith, Bigelow (U, Y). Washington: Fayetteville, Harvey (M).

OKLAHOMA. Creek: Sapulpa, Bush 1199 (M, Y). McCurtain: Shawneetown, Houghton 3889 (Y). Pittsburg: McAlester, Pennell 10595 (A, C, H, J, K, M, O, S, T, U, Y). Wagoner: Wagoner, Pennell 10610 (A, M, U, Y).

TEXAS. Bowie: Texarkana, Heller 4169 (Y).

11. *Penstemon digitalis* Nutt.

Penstemon digitalis Nutt.; Sims, in Bot. Mag. 52: pl. 2587. Aug. [1], 1825. "Communicated by Robert Barclay, . . . to whom the seeds were sent by Professor Nuttall, in March 1824, under the name which we have adopted. Native of the Arkansas territory." Careful description and illustration given. Later, independently redescribed by Nuttall himself in Trans. Am. Phil. Soc. II. 5: 181. 1837.

Chelone digitalis (Nutt.) Sweet, Brit. Fl. Gard. pl. 120. Aug. 1, 1825. "*Penstemon Digitalis* Nutt. Found by Mr. Nuttall in the Arkansas territory of North America. The plant from which our drawing was taken was received last autumn from New York, by Mr. Anderson, of the Apothecaries' Garden at Chelsea, to whom it was sent by Mr. Hogg." A careful description and illustration certainly of the plant now considered, the description being apparently more accurate than Nuttall's own, or that of Sims, in mentioning the pubescence of the anthers.

Corolla, westward, white or externally slightly purplish; eastward the corolla tends to be smaller, more purplish-tinged and with fine violet lines within throat. Flowering from mid-April to early June, depending upon latitude.

Loam or sandy soil, open woodlands, meadows and prairies; through the Ozark-Ouachita highland of Arkansas and southeastern Oklahoma; thence entering surrounding lowland, cleared Mississippi bottomland of northeastern Arkansas, fields and prairies of

northeastern Texas, etc. Native also in southern Missouri and widely introduced northeastward to the Atlantic states.

ARKANSAS. Clay: Corning, Eggert (M, Y). Izard: Guion, Pennell 10687 (Y). Jefferson: Kearney, Pennell 10657 (C, Y). Nevada: Prescott, Hollister (U). Pope: Russellville, Pennell 10, 633 (H, M, U, Y). Pulaski: Little Rock, Pennell 10650 (A, L, Y). Washington: Fayetteville, F. L. Harvey (M).

OKLAHOMA. McCurtain: Idabel, Stevens 3623 (U). Pittsburg: McAlester, Pennell 10589 (K, O, S, T, U, Y).

LOUISIANA. Caddo: Shreveport, Cocks (L). Natchitoches: Natchitoches, E. J. Palmer 7503 (M).

TEXAS. Bowie: Texarkana, Heller 4169 p. p. (A, U). Dallas: Dallas, Reverchon 3220 (Y). Tom Green: San Angelo, Reverchon 3933 (M). Van Zandt: Grand Saline, Reverchon 3934 (M).

12. *Pentstemon pentstemon* (L.) MacM.

Chelone pentstemon L., Sp. Pl. 612. 1753. "Habitat in Virginia." Type not verified, but must have been the species now considered, because in 1753 this was certainly the only essentially glabrous species of the Atlantic seaboard.

Pentstemon laevigatus Ait., Hort. Kew. 2: 361. 1789. "*Chelone Pentstemon* J. F. Miller ic. 4 . . . Nat. of North America. Cult. 1776, by John Fothergill, M. D." The description, and also the plate of Miller, clearly denote the species now considered.

Bartramia pulchella Salisb., Prod. Stirp. Chapel Allerton 99. 1796. New name for *Pentstemon laevigatus* Ait. Type of genus *Bartramia* Salisb.

Pentstemon pentstemon (L.) MacM., in Bull. Torr. Bot. Club. 19: 15. 1892.

Corolla externally violet-purplish, deepest on tube, on throat and lobes pale-purplish, nearly white on anterior side; within white, and within throat on anterior side with more or less evident violet lines. Sterile filament with yellow hairs. Flowering in May.

Meadows, or more rarely open pine-woods, pineland of central Louisiana. From Virginia to northern Florida and Louisiana, inland through the eastern Mississippi Valley to Indiana.

ARKANSAS. Hempstead: Fulton (low woods), E. J. Palmer 5418 (M).

LOUISIANA. Rapides: Alexandria, (dry pine-woods), Ball 616 (M, Y).

13. *Pentstemon tenuis* Small.

Pentstemon tenuis Small, Fl. S. E. Un. St. 1061, 1337. 1903. "Type, La., Hale, Apr., in Herb. C. U." Type, from "fertile soils," Louisiana, seen in the Herbarium of Columbia University at the New York Botanical Garden.

Corolla violet-pink externally, within paler, with or without

deep-violet lines. Flowering from early April to early June, depending upon latitude.

Heavy loam, swales and low woodland, mostly in alluvial soil, along the bottomlands of the lower Mississippi valley north to northeastern Arkansas, and also westward near the Gulf coast to the Brazos River, Texas. Near sea-level in Louisiana, Arkansas, and Texas; seen from east of the Mississippi River only from Tangipahoa Parish, Louisiana.

ARKANSAS. Hempstead: Fulton, E. J. Palmer 10514 (M). Independence: Newark, Pennell 10699 (A, C, H, J, K, M, U, Y). Miller: Mandeville, Eggert (M). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. Acadia: Crowley, Pennell 10186 (A, H, L, S, U, Y). Rapides: Alexandria, Ball 654 (M).

TEXAS. Brazoria: Brazoria; Columbia, Bush 115 (M, Y). Fort Bend: Richmond, Bray 79 (T, U). Harris: Houston, Pennell 10258 (T, Y). Liberty: Liberty, E. J. Palmer 7727 (M), 9598 (M).

14. *Penstemon arkansanus* Pennell, sp. nov.

Stems clustered, several from a clump, 3-6 dm. tall, grayish-puberulent over entire surface, often purple. Leaves membranous, slightly paler beneath, finely puberulent on both surfaces; the lowest narrowed to petiole-like bases, the longest 7-10 cm. long, obtuse to acute, crenate-serrate; the upper lanceolate, acutish to acuminate, somewhat serrate; the bracts much reduced. Thyrsus less than one-half the height of the plant, longer than wide, of 3-9 fascicles, each of two axillary branches which repeatedly branch cymosely, the pedicels much shorter than the primary peduncle. Sepals in anthesis 2-3 mm. long, in fruit 4-5 mm. long, ovate, acute to acuminate, obscurely scarious-margined, glandular-pubescent. Corolla 15-17 mm. long, the tube and throat 11-12 mm. long, the throat narrow, slightly inflated, two-ridged within distally on anterior side, the orifice open; the two posterior lobes 2-2.5 mm. long, united over one half length, their free portions upcurved-spreading; the three anterior lobes 4-5 mm. long, united at base; the corolla externally finely glandular-pubescent, internally slightly pubescent over bases of anterior lobes; white, on anterior side with violet lines. Anther-cells divaricate, oblong, dark-violet, .6-.7 mm. long, glabrous, opening throughout. Sterile filament slightly exerted, flat, not wider distally, moderately bearded distally with yellow hairs. Capsule at least 6-7 mm. long, ovate-acuminate in outline, glabrous, not seen mature.

Type, shale and sandstone woods, Pulaski Heights above Little Rock, Pulaski County, Arkansas, collected in flower and young

fruit May 31, 1920, F. W. Pennell 10640; in Herbarium of the New York Botanical Garden.

This was the plant called "*Penstemon levigatum*" by Nuttall in his *Flora of Arkansas*.

Near *Penstemon pallidus* Small, a species which has softly pubescent leaves and more acuminate sepals.

Thin rocky or sandy soil, shale or sandstone, Ozark and Ouachita mountains and hills of Arkansas and southeastern Oklahoma. Flowering in late April and May.

ARKANSAS. Carroll: Beaver; Eureka Springs, Bush 1522 (M). Garland: Hot Springs, Foreman (U). Pope: Russellville, Pennell 10629 (M, Y). Pulaski: Little Rock, Pennell 10640 (A, C, H, J, K, L, M, S, T, U, Y), 10651 (A, C, H, O, P, U, Y).

OKLAHOMA. Leflore: Page, Stevens 1374 (M, U).

14a. *Penstemon arkansanus pubescens* Pennell, n. var.

Stem 4-7 dm. tall, pubescent with fine glandless hairs, and also somewhat hirsute with spreading mostly gland-tipped hairs. Stem-leaves 20-40 mm. wide, nearly ovate, acuminate, serrate, pubescent beneath on the principal veins. Inflorescence as in the species.

Type, sandstone woodland, Penters Bluff, IZARD County, Arkansas, collected in late flower and young fruit, June 1, 1920, F. W. Pennell 10679; in Herbarium of the New York Botanical Garden.

On sandstone and limestone, IZARD county, Arkansas; probably through northern Ozarks of northern Arkansas and southern Missouri.

ARKANSAS. IZARD: Guion (limestone cliff), Pennell 10685 (A, Y), (sandstone cliff), Pennell 10690 (Y); Penters Bluff (sandstone woodland), Pennell 10679 (H, M, U, Y).

15. *Penstemon multicaulis* Pennell, sp. nov.

Stems many from a clump, 4-7 dm. tall, obscurely puberulent; often purplish. Leaves membranous, slightly paler beneath, glabrous on both surfaces; the lowest narrowed to petiole-like bases, the longest 12-18 cm. long, acuminate, sharply serrate; the upper lanceolate, mostly attenuate-acuminate, serrate; the bracts much reduced. Thyrsus less than half the height of the plant, little longer than wide, of 6-9 fascicles, each of two axillary branches which repeatedly branch cymosely, the pedicels much shorter than the long primary and secondary peduncles. Sepals in anthesis 3-4 mm. long, in fruit 5-6 mm. long, ovate-acuminate, obscurely scarious margined, glandular-pubescent. Corolla 15-17 mm. long, the tube and throat 11-12 mm. long, the throat narrow, slightly inflated,

two-ridged within on anterior side, the orifice open; the two posterior lobes 2-2.5 mm. long, united about one half length, their free portions upcurved-reflexed; the three anterior lobes 4-5 mm. long, united at base; the corolla externally finely glandular-pubescent, internally slightly pubescent over bases of anterior lobes; white, within throat, especially median to each lobe, with a few violet lines. Anther-cells divaricate, oblong, intensely violet, .5-.6 mm. long, glabrous, opening throughout. Sterile filament slightly exerted, flat, not wider distally, moderately bearded distally with yellowish hairs. Capsule at least 6 mm. long, ovate-acuminate in outline, glabrous, not seen mature.

Type, sandstone and shale cliffs, Ozark, Franklin County, Arkansas, collected in flower May 29, 1920, F. W. Pennell 10616; in the Herbarium of the New York Botanical Garden.

Along river cliffs in southern Ozarks of western Arkansas. Distribution should be studied, and constancy of characters of distinction from *P. arkansanus* noted. These seem to be well-marked.

ARKANSAS. Franklin: Ozark, E. J. Palmer 8143 (M), Pennell 10616 (A, C, H, J, K, L, M, O, P, S, T, U, Y). Also seen from Frisco Springs, "Northwest Arkansas," Wells 49 (U).

16. *Penstemon pauciflorus* Buckley.

Penstemon pauciflorus Buckley, in Proc. Acad. Nat. Sci. Phila. 1861: 461. 1862. "Past [= Post] oak woods south of Fort Belknap, [Texas, S. B. Buckley, May, 1860-61]." Fort Belknap was in Young County on the Brazos. The description inapplicable to any *Penstemon*, and at variance with the plant to which the name is now applied in these points: segments linear-subulate, corolla-tube constricted to scarcely a line in width and sterile filament glabrous with ciliated apex. Fortunately, Dr. A. Gray had seen Buckley's material in the two collections to which he sent specimens, the herbarium of the Philadelphia Academy, and that of Elias Durand. In his criticism of Buckley's proposed species [in Proc. Acad. Sci. Phila. 1862: 165. 1863] he tells us that Buckley confused, with a genuine *Penstemon*, *Phlox pilosa* L., and that most of the description applies to the latter! Also that the *Penstemon*, "a slender form of *P. pubescens*," has a sterile filament "heavily bearded," a feature particularly true of the present species. The specific name should certainly apply to the *Penstemon* component. As there appears to be but one species of this genus characteristic of post-oak woods in Texas, and that one has these features, the *Penstemon* element of Buckley could scarcely fail to have been the plant now considered. As no *Penstemon* was supplied to the Academy herbarium the type must be the plant of the Durand Herbarium, but either this admixture was culled out by Durand from his material, which is now in the Herbarium of the Academy of Natural Sciences of Philadelphia, or else it is included in the portion of his herbarium which went to Paris. Accordingly it seems best to redescribe the species.

Stems scarcely clustered, frequently but one from a root, slender, 3-7 dm. tall, minutely pubescent over entire surface, green or purplish. Leaves membranous, green, slightly paler beneath, finely pubescent to nearly glabrous; the lowest narrowed to petiole-like bases, the longest ovate to oblong, 3-10 cm. long, obtuse, crenate-

serrate, the upper lanceolate or oblong-lanceolate, obtuse or obtusish, serrate; the bracts much reduced. Thyrsus about one third the height of the plant, longer than wide, of 3-6 fascicles, each of two axillary branches, which cymosely branch 2-3 times, rarely more, the pedicels shorter than the primary peduncle. Sepals in anthesis 2-6 mm. long, in fruit 3-7 mm. long, oblong-ovate to ovate, acute to acuminate, slightly or not scarious margined, glandular-pubescent. Corolla 20-28 mm. long; the tube and throat 15-20 mm. long, the throat narrow, slightly inflated, strongly two-ridged within on anterior side, the orifice nearly closed by the up-curved base of the anterior lip; the two posterior lobes 3-5 mm. long, united and arched less than or about one half length, their free portions spreading; the three anterior lobes 5-8 mm. long, united at base; the corolla externally finely glandular-pubescent, internally slightly pubescent over the base of the anterior lobes; whitish or purplish-white, on anterior side with fine violet lines. Anther-cells divaricate, oblong, violet, 8. mm. long, microscopically puberulent, opening throughout. Sterile filament slightly exerted, flat, not wider distally, densely bearded with deep-yellow, becoming brownish-yellow hairs. Capsule 8-10 mm. long, ovate-acuminate in outline, glabrous, brown. Seeds .8-.1 mm long, sharply and slightly wing-angled; testa brown lustrous, reticulate.

Plants of coastal plain, especially in pineland and coast prairie, smaller-leaved and with stem nearly bare, while upland plants are rather leafy. Also upland plants, especially in eastern Oklahoma, are relatively more pubescent.

Sandy soil, usually open woodland or prairie, through the Coastal Plain south of the Arkansas River in Arkansas and west to the Guadalupe River in Texas, in long-leaf pineland, short-leaf pineland, coastal prairie and post-oak woods; inland in sandy or rocky woods or prairies to the Burnet metamorphic country of central Texas, and northwestward (west of the higher Ouachita Hills) to central Oklahoma. Flowering from early April to early June, depending upon latitude.

ARKANSAS. Jefferson: Jefferson Springs, Pennell 10658 (A, C, H, M, U, Y).

OKLAHOMA. Atoka: Limestone Gap, Butler 106 (M). Caddo: Hinton, Stevens 943 (M, U). Creek: Sapulpa, Bush 881 (M, Y). Lincoln: Fonts, Neaves (U). Logan: Guthrie, Carleton 147 (U). McCurtain: Idabel, Houghton 3629 (M, Y). Muskogee: Muskogee, Oyster (U). Oklahoma: Bethany, Pennell 10576 (H, K, O, P, Y). Payne: Stillwater, Waugh 253 (U). Pittsburg: McAlester, Pennell 10586 (A, C, M, Y).

LOUISIANA. Acadia: Crowley, Cocks (L). Caddo: Shreveport, Cocks 3612 (L, Y). Calcasieu: DeQuincy, Pennell 10228 (L, T, U, Y); Lake Charles, Pennell 10220 (Y). Jeff Davis: Jennings, Pennell 10206 (A, C, H, J, K, L, M, S, U, Y). Natchitoches: Natchitoches, E. J. Palmer 7305 (M). Rapides: Alexandria, Hale (U).

TEXAS. Austin: Bellville, Pennell 10301 (T, Y). Brazoria: Alvin, Young 257 (T). Burnet: Fairland, Pennell 10478 (Y). Dallas: Dallas, Reverchon 694 (M). Fayette: Colony, Crawford (M). Guadalupe: Kingsbury, E. J. Palmer 11643 (M). Hardin: Fletcher, E. J. Palmer 9549 (M). Harris: Harrisburg, Pennell 10250 (Y); Houston. Hays: San Marcos, Stanfield (Y). Hood: Granbury, Eggert (M). Jackson: Ganado, E. J. Palmer 9241 (M). Liberty: Dolen, Young (T). Milam: Milano, E. J. Palmer 11775 (M). Orange: Orange, Bray 56 (U). Polk: Livingston, E. J. Palmer 5212 (M). San Augustine: San Augustine, Crockett (U). Smith: Troup, Young (T). Tarrant: Handley, Ruth 462 (U). Travis: Austin, Pennell 10443 (Y). Victoria: Mission Valley, Schott (Y). Walker: Huntsville, Young (T).

17. ***Penstemon ambiguus*** Torr.

Penstemon ambiguus Torr., in Ann. Lyc. N. Y. 2: 228. 1828. "Hab. Near the Rocky Mountains [E. P. James in 1820]." Type collected by Edwin James either in eastern Colorado, northeastern New Mexico or northwestern Texas, seen in Herb. of Columbia University at the New York Botanical Garden.

Leiostemon purpureus Raf., Atl. Jour. 1: 145. 1832. Based upon *Penstemon ambiguus* Torr.

Sandy or rocky prairies, mostly near streams; plains north of Canadian River in extreme northwestern Texas; in the Wichita Mountains, southwestern Oklahoma; and in the western Callahan Divide, west-central Texas; doubtless elsewhere in upland Texas; Upper Sonoran Zone (at altitudes above 2,400 feet). High plains, westward to southwestern Utah and Chihuahua. Flowering from May to August.

OKLAHOMA. Comanche: Wichita Mts., Marcy (Y).

TEXAS. Dallam; Texline, Howell 138 (U). Hartley: Channing, E. J. Palmer 14157 (M). Howard: Big Springs, Tracy 7995 (M, T, Y). Martin: Stanton, Eggert (M). Ward: Monahans, Clawson 13909 (U).

18. *Penstemon baccharifolius* Hook.

Penstemon baccharifolius Hook., in Bot. Mag. 78: pl. 4627. 1852. "Rear-
ed from Texian seeds gathered by Dr. Wright." Specimen collected by
C. Wright in 1851-52, but with exact data lost, seen in Herbarium of Col-
umbia University. This must be either his 439 or 1479, both credited
by A. Gray in Torr., Bot. Mex. Bound. 114. 1859, as collected on "rocky
bluffs at the Big Bend of the San Pedro River, Texas." Evidently the
type station.

Limestone ledges, bluffs and canyons, in Edwards and Uvalde
Counties, Texas; and Rio Grande portion of Lower Sonoran Zone
(at altitudes of 1,000 to 1,500 feet). Ranges westward through
Trans-Pecos Texas. Flowering from April to June.

TEXAS. Edwards: Barksdale, E. J. Palmer 11009 (M), 12337
(M). Uvalde: Montell, E. J. Palmer 12323 (M). Valverde:
Viaduct, Pilsbry (A).

Penstemon atropurpureus Raf., Atl. Jour. 1: 176. 1833 [not *P.*
atropurpureus (Sweet) G. Don 1830], said to be from Texas or
"Arkansas," to be represented by a specimen or specimens in
Rafinesque's herbarium and to have been seen living by him, is
described as with leaves "ang. lanc. amplexic. serrul. glabr.
acutissim." and flowers "small, dark purple." Probably two
species are confused, but I can identify neither as Texan.

16. **SCROPHULARIA** Linné.

Scrophularia L., Sp. Pl. 619. 1753.

Type species, *S. nodosa* L., of Europe.

Sterile filament greenish-yellow, 1.8 mm. wide. Corolla 8-12 mm.
long. Calyx-lobes acute or acutish. Capsule pyramidal-acum-
inate, 5-10 mm. long. Seeds .8-1 mm. long. Inflorescence
narrowly elongated, 4-8 cm. wide, its branches relatively stout.
Leaf-blades cuneate to truncate at base, coarsely serrate to
incised. Petioles stouter, evidently wing-margined.

1. *S. occidentalis*.

Sterile filament purple-brown, 1 mm. wide. Corolla 6-8 mm. long.
Calyx-lobes rounded-obtuse. Capsule ovoid, acute, 4-7 mm. long.
Seeds .5-.8 mm. long. Inflorescence pyramidal, 5-18 cm. wide,
its branches slender. Leaf-blades narrowed to cordate at base,
more finely crenate-serrate. Petioles slender, scarcely margined.

2. *S. marilandica*.1. *Scrophularia occidentalis* (Rydb.) Bicknell.

Scrophularia nodosa occidentalis Rydb., in Contrib. U. S. Nat. Herb. 3: 517.
1896. "Rapid City [South Dakota], altitude 1,000 m., July 25, [1892.
P. A. Rydberg] (No. 914)." Isotype seen in Herb. New York Botanical
Garden.

Scrophularia occidentalis (Rydb.) Bickn., in Bull. Torr. Bot. Club 23: 315.
1896.

Corolla externally greenish-brown and shining, within green or

distally brownish. Flowering in May or June.

Thickets and along streams, widely distributed through the Rocky Mountain plateau, eastward passing into *S. leporella* Bickn. In our area seen only as collected by Edward Palmer 218 at some point in Oklahoma, probably "on the False Washita, between Fort Cobb and Fort Arbuckle" in 1868.

OKLAHOMA.—: —, E. Palmer 218 (Y).

2. *Scrophularia marilandica* L.

Scrophularia marilandica L., Sp. Pl. 619. 1753. "Habitat in Virginia."

Based upon a plant grown in the Upsala Garden, which from the description in the Hortus Upsalensis 177. 1748, would appear to have been the species here considered.

(?) *Scrophularia hastata* Raf., Fl. Ludov. 44. 1817. Based upon a fuller description in Robin, Voy. Louisiane 3: 395. 1807. Description of leaves 'soft to touch' appears to describe forma *neglecta* (below), but the leaves in this species can scarcely be called hastate. The carefully described flower however would appear to be of this genus, although no mention is made of the rudimentary fifth stamen, nor is the corolla ever pubescent within (veloutée).

Scrophularia neglecta Rydb.; Small, Fl. S. E. Un. St. 1058, 1337. 1903. "Type, Riley Co., Kans., Norton, no. 779 in Herb. N. Y. B. G." Type seen in Herb. New York Botanical Garden. This plant differs from what is considered true *S. marilandica* only in the presence of pubescence on the lower surface of the leaves, a condition found in the northern and predominating in the western part of the range of the species. Eastward this sporadic and fluctuating state can be only considered as a forma, *neglecta* (Rydb.) Pennell, comb. nov; the two should be studied.

Corolla externally greenish-brown, duller, within purple-brown distally. Flowering in September and October.

Open woodland, in central and northwestern Arkansas; and in southern Louisiana; certainly more generally distributed in our area. In our area only forma *neglecta* has been seen. A wide-spread eastern species, ranging from Massachusetts to Ontario and Nebraska, south to Georgia and Louisiana.

ARKANSAS. Benton: —, Plank (Y). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. Iberia: Avery Id., Cocks (L, Y).

17. *COLLINSIA* Nuttall.

Collinsia Nutt., Journ. Acad. Nat. Sci. Phila. 1: 190. 1817.

Type species, *C. verna* Nutt., of Ohio.

1. *Collinsia violacea* Nutt.

Collinsia violacea Nutt., in Trans. Am. Phil. Soc. II. 5: 179. 1837. "Hab. On the hills and upland woods of the Arkansas and Red rivers; abundant. [T. Nuttall.] Type, labeled "Ark[ansas], Nuttall," seen in Herb. Academy of Natural Sciences of Philadelphia; isotype in Herb. of Columbia University at the New York Botanical Garden.

Sandy soil, hills of western Arkansas, and eastern Oklahoma and southward into short-leaf pineland of eastern Texas to Nacogdoches and Limestone counties, Texas. Also in extreme south-western Missouri and southeastern Kansas. Flowering from March to early May, and soon ripening fruit.

ARKANSAS. Benton: —, Plank (Y). Sebastian: Hartford, Pilsbry (A). Washington: Fayetteville, Williamson (A).

OKLAHOMA. Atoka: Limestone Gap, Pilsbry (A). Craig: Vineta, Carleton 33 (U). Creek: Sapulpa, Bush 918 (Y).

TEXAS. Kaufman: Elmo, Reverchon 3935 (U). Limestone: —, Joor 49 (U). Nacogdoches: "Nagadoches," Leavenworth (A).

Readily distinguished from *C. verna* Nutt., of the Ohio Valley, by the following contrast:

Corolla blue, the nearly white posterior lobes little shorter than the shallowly notched antero-laterals. Seeds 3 mm. long. Leaves lanceolate-ovate, mostly obviously dilated proximally. Stem and pedicels with lines of pubescence. *C. verna*.

Corolla violet, the pale posterior lobes about two thirds the length of the deeply notched antero-laterals. Seeds 1 mm. long. Leaves oblong-lanceolate, not dilated at base. Stem and pedicels more densely finely pubescent over entire surface. *C. violacea*.

18. **MAURANDYA** Ortega.

Maurandya Ortega, Nov. Pl. Descr. Decad. 21. 1797.

Type species, *M. semperflorens* Ortega,⁸ of Mexico.

1. ***Maurandya antirrhiniflora*** Humb. & Bonpl.

Maurandya antirrhiniflora H. & B.; Willd., Hort. Berol. pl. 83. 1807. "Habitat in Mexico." Description distinctive.

Antirrhinum maurandioides A. Gray, in Proc. Am. Acad. 7: 376. 1868.

Based upon *Maurandya antirrhiniflora* G. & B.

Certainly closely akin to *M. scandens* (Cav.) Pers. [= *M. semperflorens* Ort.], being nearly alike in habit, leaves, pedicels, sepals, capsules and seeds, differing only in corolla. In *M. scandens* this is two-ridged within on anterior side, apparently in the manner of *Mimulus*, while the smaller corolla of *M. antirrhiniflora* has these ridges developed distally into a palate.

Corolla blue, the palate conspicuously raised, light-yellow. Flowering from April to September and soon ripening fruit.

Stony calcareous soil, river-bluffs and hills, lower Edwards Plateau and through arid southern Texas, from Travis and Gillespie to

⁸ Practically a re-description, with renaming, of *Usteria scandens* Cav., Icon. 15. 1793, antedated by *Usteria* Medik., 1790.

Nueces and Webb counties; lower Sonoran zone. Ranges from southern Texas and Arizona to southern Mexico.

TEXAS. Bexar: Comanche Spring; San Antonio, Pennell 5472 (P, Y). Gillespie: Threadgill, Jermy 487 (U). Hays: San Marcos, Pennell 10428 (A, Y). Nueces: Corpus Christi, Heller 1790 (A, U, Y). Travis: Austin, Pennell 10451 (Y); Barton Springs. Webb: Laredo, Letterman 35 (Y).

19. **LINARIA** Miller.

Linaria Mill., Gard. Dict. ed. IV. 1754.

Type species, *Antirrhinum linaria* L., of Europe.

Corolla, excluding spur, 4-12 mm. long, blue; posterior lip erect; anterior lip broadly spreading, but not forming a definite raised palate; spur slender. Capsule 2-3.5 mm. long, equaling to slightly exceeding the sepals. Seeds .3-.4 mm. long, cylindric, prismatic-angled, not winged. Stem less leafy, the younger stems spreading-prostrate from base.

(*Leptoplectron*.)

Surfaces of seeds smooth to slightly tuberculate, the angles thin.

Corolla less than 48 mm. long, excluding the spur which is 2-6 mm. long.

1. *L. canadensis*.

Surfaces and rounded angles of seed densely tuberculate. Corolla over 10 mm. long, excluding the spur which is 5-9 mm. long.

1a. *L. canadensis texana*.

Corolla, excluding spur, 15-18 mm. long, yellow; posterior lip arched over anterior; anterior lip forming a conspicuous protruding orange palate, spur stout. Capsule 10 mm. long, much exceeding the sepals. Seeds 1-7 mm. long, flattened and circularly broadly-winged. Stem densely leafy, always erect.

2. *L. linaria*.

1. **Linaria canadensis** (L.) Dum.-Cours.

Antirrhinum canadense L., Sp. Pl. 618. 1753. "Habitat in Virginia, Canada." Type probably from southern New Jersey, and certainly the species now considered. For discussion see Torrey 19: 151. 1919.

Linaria canadensis Dum.-Cours., Bot. Cult. 2: 96. 1802. "Lieu, Le Canada, la Virginie." Doubtless based upon *Antirrhinum canadense* L.

Corolla purplish-blue, the palate paler. Flowering from March to May, and soon ripening fruit.

Open sandy soil, usually a weed, eastward, chiefly in the Coastal Plain; less frequent than the following, with which it intergrades. Ranges through the Atlantic Coastal Plain, from Massachusetts to Florida and Texas; inland probably introduced.

ARKANSAS. Pope: Russellville, Pennell 10636 (Y).

LOUISIANA. Rapides: Alexandria, Hale (A, U, Y).

TEXAS. Angelina: —, Reverchon 3931 (Y). Dewitt: Cuero, Howell 318 (Y). Harris: Houston, Hall 406 (U). Kaufman: Terrell, Tyler (U). San Augustine: San Augustine, Crocket (U). Travis: Austin, York (T). Victoria: Victoria, Lewton 62 (U).

1a. *Linaria canadensis texana* (Scheele) Pennell, comb. nov.

Linaria texana Scheele, in *Linnaea* 21: 4761. 1848. "Zwischen Houston and Austin [Texas] häufig: "Römer." Description sufficiently distinctive.

Here distinguished primarily by roughness of seeds, which however varies from a few roughenings on the side to densely tuberculate. The wealth of Texan material at my disposal shows that each character of the contrasts previously outlined (in Contrib. U. S. Nat. Herb. 20: 323. 1920, and Proc. Acad. Nat. Sci. Phila. 71: 258. 1920) between this and *Linaria canadensis* breaks down in numerous instances through the area where the two overlap. Consequently it seems more rational to consider *texana* a variety, its range and relation to the species roughly paralleling that of *Veronica peregrina xalapensis* (H. B. K.) Pennell. For an excellent illustration of *Linaria canadensis texana* see the Botanical Magazine 63: pl. 3473. 1836.

Open sand or sandy loam, frequently or usually a weed, common through the Coastal Plain, chiefly westward; occasional and probably introduced inland. Ranges widely through western North America, and into South America.

ARKANSAS. Benton: —, Plank (Y). Columbia: Taylor, Hunt 10 (Y). Nevada: Prescott, Bush 555 (U).

OKLAHOMA. Kingfisher: Huntsville; Kingfisher, Stevens 189 (U). Oklahoma: Bethany, Pennell 10574 (H, O, U, Y). Payne: Stillwater, Learn (Y). Wagoner: Wagoner, Pennell 10614 (M, Y). Washita: Bessie, Stevens 961 (U). Woods: Alva, Stevens 3042 (U).

LOUISIANA. Acadia: Crowley, Pennell 10204 (Y). Catahoula: Sicily Id., Peck (A). Rapides: Alexandria, Ball 416 (U, Y). Terrebonne: E. C. Wurzelow (Y).

TEXAS. Austin: San Felipe, Pennell 10293 (K, T, Y); Wallis, Pennell 10270 (A, Y). Bastrop: Smithville, Pilsbry (A). Bexar: San Antonio: Larrabee (U). Duval: San Diego, Croft (U, Y). Fayette: Colony, Crawford (U). Gillespie: Dry Branch, Jermy 151 (U). Harris: Houston, Bush 51 (U). Henderson: Athens, Young (T). Kaufman: Terrell, Tyler (U). Nueces: Corpus Christi, Heller (Y). Robertson: Calvert, Merrill (Y). Tarrant:

Handley, Ruth 441 (Y). Travis: Austin, Bray 106 (Y). Victoria: Victoria, Williamson (A).

2. *Linaria linaria* (L.) Karst.

Linaria vulgaris Mill.

Loam or sandy fields, seen only from northern Arkansas. Naturalized from Eurasia.

20. **VERONICASTRUM** Heister.

Veronicastrum Heist.; Fabr., Enum. Meth. Pl. Hort. Helmstad. 111. 1759.

Type species, *Veronica virginica* L.

1. *Veronicastrum virginicum* (L.) Farwell.

Veronica virginica L., Sp. Pl. 9. 1753. "Habitat in Virginia." Grown in the Clifford Garden. Certainly the species here considered.

Leptandra villosa Raf., Med. Fl. 2: 21. 1830. "Mr. Schweinitz has found it in North Carolina." Name to be used for the forma *Veronicastrum virginicum* f. *villosum* (Raf.) Pennell, [in *Rhodora* 23: 6. 1921] prevalent in the South and West, which has its leaves downy pubescent beneath.

Veronicastrum virginicum (L.) Farwell, Drugg. Circ. 61: 231. 1917.

Corolla white or pinkish; anthers brown. Flowering in August.

Sandy or loam soil, meadows or thickets, in northern Louisiana and northeastern Texas; doubtless also in Arkansas. Ranges from Connecticut to Minnesota and Kansas, south to Mississippi and Texas.

LOUISIANA. Clairborne: ———, (L). Natchitoches: Natchitoches, Cocks (L).

TEXAS. Bowie: Texarkana, Heller 4198 (A, Y).

21. **VERONICA** Linné.

Veronica L., Sp. Pl. 9. 1753.

Type species, *Veronica officinalis* L., of Europe.

Main stem terminating in an inflorescence, the flowers remote and axillary. Leaves, except the lowermost, alternate, their blades oblanceolate to ovate. Annuals.

Pedicles shorter than the lanceolate to linear sepals. Capsule strongly flattened. Seeds many, less than 1 mm. long, smooth or nearly so. Plants erect.

Leaf-blades, excepting the lowermost, sessile, those of the lower stem-leaves oblanceolate, nearly entire to dentate.

Corolla whitish throughout. Capsule greenish-brown, glabrous or minutely pubescent, less deeply notched, the minute style hidden between the capsule-lobes.

Plant glabrous.

1. *V. peregrina*.

Plant pubescent with short gland-tipped hairs, usually present even on the capsule.

1a. *V. peregrina xalapensis*.

Leaf-blades petioled or the upper nearly sessile, those of the lower stem-leaves ovate, crenate-serrate. Corolla deep violet-blue. Capsule yellowish-brown, pubescent with slightly gland-tipped hairs, notched nearly or about one third length, the longer style reaching about to the capsule-lobes. Plant pubescent with white glandless or obscurely gland-tipped hairs.

2. *V. arvensis*.

Pedicels longer than the ovate sepals. Capsule relatively turgid. Seeds few, 1.3-1.5 mm. long, roughened. Leaf-blades ovate, dentate. Corolla violet-blue.

Petals not exceeding the ovate sepals. Capsule 4 mm. wide, its lobes rounded in profile, the most distal point of each about midway between the style and the lateral margin. Style shorter than the capsule.

3. *V. polita*.

Petals much exceeding the narrowly ovate sepals. Capsule 5-6 mm. wide, its lobes acutish in profile, the most distal point of each near the lateral margin. Style as long as the capsule.

4. *V. persica*.

Main stem not terminating in an inflorescence, the flowers in axillary racemes. Leaves opposite throughout, their blades linear. Perennial.

5. *V. scutellata*.

1. *Veronica peregrina* L.

Veronica peregrina L., Sp. Pl. 14. 1753. "Habitat in Europae hortis, arvisque." Description distinctive of this American plant, which had become naturalized in Europe.

Corolla uniformly dull-white. Flowering from March to May, and soon ripening fruit.

Moist soil, river-banks, gardens and cultivated fields, common eastward but passing into and over most of our range represented by the following variety. Wide-spread through eastern North America.

ARKANSAS. Jefferson: Jefferson Springs, Pennell 10669a (Y). Pope: Russellville, Pennell 10635 (U, Y).

LOUISIANA. Acadia: Crowley, Pennell 10197 (L, Y). Jefferson: Gretna, Ball 322 (Y). Rapides: Alexandria, Hale (L).

1a. *Veronica peregrina xalapensis* (H. B. K.) Pennell.

Veronica xalapensis H. B. K., Nov. Gen. et Sp. 2: 389. 1818. "Crescit in Regno Mexicano prope Xalapa (alt. 630 hex.), in nemoribus *Liquidambaris Styracifluae* [Humboldt & Bonpland]".

Veronica peregrina xalapensis (H. B. K.) Pennell, in *Torrey* 19: 167. 1919.

Varies in degree and length of pubescence, so evidently of only varietal status.

Sandy to clayey soil, ditches, stream-banks and fields, common through most of central and western Arkansas and Texas, eastward

passing into *V. peregrina* L. Wide-spread through western North and South America.

ARKANSAS. Franklin: Ozark, Pennell 10618 (Y).

OKLAHOMA. Oklahoma, Bethany, Pennell 10580 (O, Y).

TEXAS. Austin: Wallis, Pennell 10281 (U, Y). Bexar: —, Jermy (Y). Comal: New Braunfels, Lindheimer 1060 (T, Y). Harris: Houston, Pennell 10248 (Y), 10255 (T, Y). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Pennell 10391 (A, H, Y). Tarrant: Fort Worth, Ruth 100 (Y). Travis: Austin, Pennell 10446 (Y).

2. *Veronica arvensis* L.

Corolla with all lobes deep sky-blue, whitish at base, veined with deeper sky-blue.

Fields and cultivated soil, especially where moist, seen from Arkansas and Oklahoma. Naturalized from Eurasia.

3. *Veronica polita* Fries.

Roadsides and gardens, seen from Louisiana and Texas. Naturalized from Eurasia.

4. *Veronica persica* Poir.

Corolla with posterior lobes sky-blue, anterior pale-blue, all whitish at base, and veined with deeper blue lines.

Fields and roadsides, seen from Texas. Naturalized from Eurasia.

5. *Veronica scutellata* L.

Waste ground, at Pineville, Rapides Parish, Louisiana, collected by R. S. Cocks. Surely adventive from the northern United States or Eurasia.

22. **DASISTOMA** Rafinesque.

Dasistoma Raf., Journ. de Phys. 88: 89. 1819.

Type species, *D. aurea* Raf., of Kentucky.

1. *Dasistoma macrophylla* (Nutt.) Raf.

Seymeria macrophylla Nutt., Gen. N. Am. Pl. 2: 49. 1818. "Hab. In shady alluvial soils of the banks of the Little Miami, near the town of Lebanon," Ohio, T. Nuttall. Specimen in Kew Herbarium labeled "Ohio, Nuttall misit Mart. 1824," may stand as the type; this seen.

Dasistoma macrophylla (Nutt.) Raf., New Fl. Am. 2: 67. 1837.

Brachygyna macrophylla (Nutt.) Small, Fl. S. E. Un. St. 1073, 1338. 1903. Type of genus, *Brachygyna* Small.

Corolla yellow, externally tinged or marked with purple-red. Flowering in July and August and soon ripening fruit.

Sandy to clay soil, woodland, usually along streams, hills of northwestern Arkansas and eastern Oklahoma to Dallas County, Texas. Ranges from Ohio to eastern Nebraska, south to northern Alabama and northeastern Texas.

ARKANSAS. Benton: Sulphur Springs, Pennell 5362 (P). Washington: Fayetteville, Harvey 35 p. p. (A).

OKLAHOMA. Cleveland: Moore, McReynolds (O). Craig: Blue Jacket, Stevens 2212 (L). Creek: Sapulpa, Bush 446 (M). Payne: Stillwater, Waugh 33 (M, U). Rogers: Verdigris, Bush 415 (M).

TEXAS. Dallas: Dallas; Irving, Pennell 5398 (P, Y).

23. **AFZELIA** J. F. Gmelin.

Afzelia J. F. Gmel., Syst. 927. 1791.

Type species, *Anonymos cassioides* Walt.

Leaf-segments and calyx-lobes lanceolate or broader. Corolla externally pubescent, its lobes ovate. Capsule ovate or ovate-acuminate, glandular-tomentose. Seeds 1-1.5 mm. long, with reticulations raised and wing-like. Stem with spreading or reflexed hairs.

Filaments 1.5-2.5 mm. long, dilated and pubescent at least one half their length, the distal portion glabrous. Anther-cells, opening one half their length. Capsule ovate-acuminate with gland-tipped hairs. Reticulations of seed regular, raised less than the diameter of the seed. Stem glandular-pubescent with spreading hairs.

Capsule 9-12 mm. long. Seeds 1-1.2 mm. long. Pedicels 7-12 mm. long. Leaf-blades slightly bipinnatifid.

1. *A. havardii*.

Capsule 8-9 mm. long. Seeds 1.4-1.5 mm. long. Pedicels 3-5 (-9) mm. long. Leaf-blades strongly bipinnatifid.

2. *A. texana*.

Filaments 3 mm. long, dilated and pubescent about one fourth their length, the distal portion lanose with spreading hairs. Anther-cells opening one fourth or one fifth length. Capsule 5-7 mm. long, ovate, with mostly dark-jointed but not gland-tipped hairs. Reticulations of seed irregularly produced into three or four wings, which equal or exceed the diameter of the seed. Stem pubescent with fine reflexed or also longer spreading glandless hairs.

3. *A. pectinata*.

Leaf-segments and calyx-lobes filiform-linear. Corolla externally glabrous, its lobes lanceolate. Capsule 4-4.5 mm. long, urceolate-acuminate, glabrous. Seeds .5-.7 mm. long, with a scarcely reticular testa, furrowed. Stem sparingly pubescent with ascending incurved hairs.

4. *A. cassioides*.

1. *Afzelia havardii* Pennell, sp. nov.

Annual. Stem about 4 dm. tall, much branched, pubescent with retrorse-spreading to -incurved hairs, and with longer similar gland-tipped hairs. Leaf-blades lanceolate to ovate-lanceolate, slightly bipinnatifid, segments lanceolate, pinnae falcately spreading; glandular-hirsute on both surfaces; those of the stem 1.5-1.7 cm. long; 6-8 mm. wide, with 5-7 pairs of lateral lobes. Pedicels slender, in flower 6-10 mm. long, in fruit 7-12 mm. long. Calyx glandular-hirsute, its lobes 3-4 mm. long, lanceolate, acute, dentate. Corolla 7.5-8 mm. long; its lobes 5 mm. long, ovate; rounded, spreading, the two posterior united $\frac{1}{2}$ - $\frac{3}{5}$ their length; externally glandular-tomentose, within pubescent in a ring about the bases of the filaments, but glabrous below posterior sinus, the lobes irregularly ciliate. Filaments 2.5 mm. long, stout, posterior incurved, dilated and pubescent two-thirds length; anterior straight, less dilated, pubescent one-half length; connectives glabrous, anther-sacs 3 mm. long, linear-oblong, opening one-half length. Capsule 9-12 mm. long, narrowly ovate-acuminate, glandular-tomentose. Seeds 1-1.2 mm. long, pale-brown, the raised reticulations thin and somewhat wing-like; intrareticular lines very fine, continuous, forming a delicate parallel series.

Type, Eagle Pass, Texas, collected in flower and fruit in 1882, Dr. V. Havard; in Herb. Academy of Natural Sciences of Philadelphia.

Limestone hills (?), near the Rio Grande, Texas; arid Lower Sonoran zone.

TEXAS. Maverick: Eagle Pass, Havard (A, H). Also collected by Wright in 1848, but no station given.

2. *Afzelia texana* (A. Gray) Small.

Seymeria bipinnatisecta texana A. Gray, in Torrey, Bot. Mex. Bound. 117. 1859. "Upper Guadalupe river, etc.; Lindheimer . . ." Several collections of Lindheimer seen, but none labeled "Upper Guadalupe river." Lindheimer 451 or 670 labeled "Pedernales," in Gray Herbarium, may stand as the type and has been seen there.

Afzelia texana (A. Gray) Small, Fl. S. E. Un. St. 1072, 1338. 1903.

Rocky limestone soil, Edwards Plateau of central Texas. Flowering in July and August, and soon ripening fruit.

TEXAS. Bexar: Comanche Spring, Lindheimer 1058 (A, C, H, K, M, P, U, Y). Gillespie: Fredericksburg; Pedernales; Threadgill, Jermy 452 (M, U). Hays: San Marcos, Stanfield (Y). Kerr: Kerrville, Pennell 10395 (T, Y).

3. *Afzelia pectinata* (Pursh) Kuntze.

Seymeria pectinata Pursh, Fl. Am. Sept. 2: 737. 1814. "In South Carolina. Catesby. v. s. in Herb. Sherard." Type not seen, but description distinctive.

Afzelia pectinata (Pursh) Kuntze, Rev. Gen. 1: 457. 1891.

Corolla deep golden-yellow, more or less marked with purple-red within throat and at the bases of the lobes. Flowering in August and September, and soon ripening fruit.

Dry sandy longleaf pineland, central Louisiana. Ranges from South Carolina and Florida to Louisiana.

LOUISIANA. Natchitoches: Natchitoches, Cocks (L).

4. *Afzelia cassioides* (Walt.) J. F. Gmel.

Anonymos cassioides Walt., Fl. Carol. 171. 1788. Presumably from lower South Carolina. Description sufficiently distinctive.

Afzelia cassioides (Walt.) J. F. Gmel., Syst. 927. 1791.

Gerardia afzelia Michx., Fl. Bor. Am. 2: 20. 1803. New name for *Afzelia cassioides* (Walt.) Gmel.

Seymeria tenuifolia Pursh, Fl. Am. Sept. 737. 1814. New name for *Gerardia cassioides* (Walt.) Pers.

Corolla pale-yellow, more or less marked with purple-red within throat and at the bases of the lobes. Flowering in September and October, and soon ripening fruit.

Sandy longleaf pineland, central Louisiana. Ranges from North Carolina and Florida to Louisiana.

LOUISIANA. Rapides: Alexandria, Cocks (L).

24. **AUREOLARIA** Rafinesque.

Aureolaria Raf., New Fl. Am. 2: 58. 1837.

Type species, *Aureolaria villosa* Raf.

Annual. Stem, leaves and calyx glandular-hirsute. Leaf-blades bipinnatifid, pectinately toothed. Calyx-tube glandular-hirsute, the lobes pectinately toothed. Corolla 30-40 mm. long, externally glandular-pubescent, with pubescent below posterior sinus and over bases of posterior lobes, more or less marked or tinged with purple-red. Capsule glandular-pubescent. Seeds .8-1 mm. long, not winged. (*Panctenis* Raf.)

1. *A. pectinata*.

Perennials. Not glandular. Leaf blades entire to somewhat bipinnatifid, not pectinately cut. Calyx-tube not glandular, the lobes entire to dentate. Corolla externally glabrous, within glabrous or diffused-pubescent, uniformly yellow. Capsule not glandular. Seeds 1.5-2.7 mm. long, strongly winged. (*Aureolaria*, sensu strictu.)

Capsule densely rusty-pubescent. Pedicels 1.5-3 mm. long. Stem puberulent to pubescent.

2. *A. virginica*.

Capsule glabrous. Pedicels 3-15 mm. long.

Plants densely cinereous-puberulent. Wings but one sixth to one fifth the diameter of the seeds. Corolla 40-50 mm. long.

Calyx-lobes broadly lanceolate, evidently dentate. Bracts

coarsely toothed. Petioles apparently mostly only 5-6 mm. long.

3. *A. grandiflora*.

Calyx-lobes linear to lanceolate, entire to slightly dentate. Bracts entire to serrate. Petioles mostly 10-15 mm. long.

Upper leaf-blades gradually smaller than the lower, relatively large. Pedicels stout. More densely cinereous.

3a. *A. grandiflora cinerea*.

Upper leaf-blades rather abruptly smaller than the lower, relatively small. Pedicels slender. Less densely cinereous.

3b. *A. grandiflora serrata*.

Plants glabrous to minutely puberulent. Wings one fourth to two fifths the diameter of the seed. Calyx-lobes entire. Stem finely puberulent, not glaucous. Pedicels and calyx externally puberulent. Corolla 40-50 mm. long.

4. *A. dispersa*.

Stem glabrous, glaucous. Pedicels and calyx externally glabrous.

Leaf-blades, at least the lower, somewhat pinnately cut, the segments lanceolate or broader. Corolla 40-60 mm. long, somewhat pubescent within above bases of filaments. Awn of anther 1-1.5 mm. long. Capsule 15-29 mm. long. Plant relatively stout.

5. *A. flava macrantha*.

Leaf-blades all very deeply pinnately cut, the segments linear-lanceolate or nearly linear. Corolla 40-45 mm. long, glabrous within above bases of filaments. Awn of anther 1.5-2 mm. long. Capsule 12-15 mm. long. Plant relatively slender.

6. *A. calycosa*.

1. *Aureolaria pectinata* (Nutt.) Pennell.

Gerardia pedicularia pectinata Nutt., Gen. N. Am. Pl. 2: 46. 1818. "Hab.

In the sandy pine forests of Carolina and Georgia." Probable type, collected by Nuttall and now in the British Museum, has been verified by Dr. S. Moore as the plant here considered.

Aureolaria pectinata (Nutt.) Pennell, in Bull. Torr. Bot Club. 40: 314. 1913.

Corolla yellow, externally more or less tinged with reddish, within not marked with purple-red. Flowering from July to October, and soon ripening fruit.

Dry sandy pine and oak lands, especially hilly, in the Coastal Plain of Louisiana, and doubtless also in eastern Arkansas; on the lower Ouachita Hills in Arkansas. Ranges through the Coastal Plain from South Carolina to Florida and Louisiana.

ARKANSAS. Garland: Hot Springs, Pennell 5680 (A, C, H, K, M, P, U, Y). Pulaski: Little Rock, Engelmann 313 (M).

LOUISIANA. Caddo: Shreveport, Cocks (L). Rapides: Alexandria; Pineville, Pennell 5638 (C, H, L, M, P, U, Y).

2. *Aureolaria virginica* (L.) Pennell.

Rhinanthus virginicus L., Sp. Pl. 603. 1753. "Habitat in Virginia." Type, Clayton 488, is identified by Dr. S. F. Blake in *Rhodora* 20: 66, 1918, as the species here considered.

Aureolaria villosa Raf., New Fl. Am. 2: 59. 1837. No type locality stated, nor type known to exist. Description sufficiently distinctive.

Aureolaria virginica (L.) Pennell, in Bull. Torr. Bot. Club. 40: 409. 1913.

Corolla yellow, with no tinge of purple-red. Flowering in June or July.

Open sandy woodland, among oaks, in central Louisiana. Ranges from New Hampshire to Michigan, south to Florida and Louisiana. Unknown elsewhere west of the Mississippi River.

LOUISIANA. Rapides: Alexandria, Hale (L).

3. *Aureolaria grandiflora* (Benth.) Pennell.

Gerardia grandiflora Benth., in Comp. Bot. Mag. 1: 206. 1826. "Province of Texas, Drummond." Type, Drummond 293, seen in Kew Herbarium.

Dasystoma drummondii Benth., in DC. Prod. 10: 520. 1846. "In Texas (Drummond!) *Gerardia grandiflora* Benth! . . . (v. s.)" Type, identical with preceding, Drummond 293, seen in Kew Herbarium.

Aureolaria grandiflora (Benth.) Pennell in *Rhodora* 20: 135. 1918.

Probably in sandy oak woods, Coastal Plain of southeastern Texas. Including varieties, the species ranges northward to Wisconsin. Flowering in June and July.

TEXAS. Austin: San Felipe, Drummond 293 (H, K). Harris: Houston, Hall 420 (H, K, M, U, Y). Waller: Hempstead, Hall 419 (H, M, U, Y)

3a. *Aureolaria grandiflora cinerea* Pennell, var. nov.

Stem 10-12 dm. tall, more densely cinereous-puberulent. Petioles about 10-15 mm. long. Lower leaves lanceolate to ovate lanceolate usually more deeply incised, though only at times in broad basal portion of lowest leaves reaching nearly to the midrib, (5-) 9-15 cm. long, with 2-6 pairs of lateral lobes, rarely nearly entire, upper leaves smaller, though larger than in the species, and less cut; bracts nearly entire, or more frequently serrate, or even lacinate toward the base; leaves more cinerous. Pedicels stouter. Calyxlobes 8-12 mm. long, linear-lanceolate to lanceolate, entire or slightly dentate. Capsule 13-17 mm. long. Otherwise as in the species.

Type: Neck, Jasper Co., Missouri, collected in fruit, F. W. Pennell 5374; in Herb. University of Pennsylvania.

Corolla yellow, with no tinge of purple-red. Flowering in July and August, fruiting September and October.

Dry oak-woods, red loam or on usually more or less sandy soil, from the valley of the Missouri River in central Missouri to the upper Trinity River in Texas.

ARKANSAS. Washington: Fayetteville, Harvey 59 (M).

OKLAHOMA. Cleveland: P. J. White 191 (M). Haskell: San Bois Mts., Sheldon 325 (U). LeFlore: Page, Stevens 2709 (I).

Texas. Dallas: Dallas, Reverchon 711 (M, U). Smith: Swan, Reverchon 3228 (M).

3b. *Aureolaria grandiflora serrata* (Torr.) Pennell, comb. nov.

Dasystoma drummondii serrata (Torr.) Benth., in DC. Prod. 10: 521. 1846.

"In Louisiana ad Red River (Hale!) *Gerardia serrata* Torrey!
(V. in herb. Torrey)." Type in Kew Herbarium verified by N. E. Brown
as agreeing with my number 5675. Isotype seen in Herbarium Columbia
University.

Gerardia grandiflora integriscula A. Gray, Syn. Fl. N. Am. 2. 1: 291. 1878.
G. serrata, Torr., Benth. . . . W. Louisiana, Hale." Type same as pre-
ceding.

Corolla yellow, with no tinge of purple-red. Flowering in July and August.

Sandy oak-woods, short-leaf pine region of northwestern Louisiana and northeastern Texas, probably also in the long-leaf pinehills north of Alexandria, Louisiana.

LOUISIANA. Caddo: Shreveport, Pennell 5662 (A, C, H, I, L, M, P, U, Y). Natchitoches: Chopin, E. J. Palmer 8847 (M). Rapides Alexandria, Hale (L, Y).

TEXAS. Bowie: Texarkana, Pennell 5675 (A, C, H, K, M, P, S, T, U, Y). Rusk or Panola: between Tatum & Beckville. Reverchon 3227 (H, M, U).

4. *Aureolaria dispersa* (Small) Pennell.

Dasystoma dispersa Small, in Bull. Torr. Bot. Club. 28: 452. 1901. "Louisiana, Feliciana, Carpenter; type in the Herb. of Columbia University."
Type seen.

Aureolaria dispersa (Small) Pennell, in Bull. Torr. Bot. Club. 40: 411. 1913.

Corolla yellow, with no tinge of purple-red. Flowering in August and September.

Sandy thickets and oakland, in the long-leaf pine belt of southern Louisiana. Ranges eastward to southern Alabama.

LOUISIANA. Acadia: Crowley, Pennell 10188 (Y). Rapides: Pineville, Pennell 5639 (C, H, L, M, P, U, Y).

5. *Aureolaria flava macrantha* Pennell, var. nov.

Leaves tardily glabrate or permanently pubescent above. Calyxlobes 5-14 mm. long. Corolla (35-) 40-60 mm. long. Capsule 15-20 mm. long. Otherwise as in the species, *Aureolaria flava* (L.) Farwell.

Corolla yellow, with no tinge of purple-red. Flowering from July to September, fruiting August to October.

Oakwoods, frequently sandy or rocky, in the Ouachita Hills of central Arkansas. Ranges from southern Ontario to Alabama, Illinois and Arkansas, eastward passing into the species.

ARKANSAS. Garland: Hot Springs, Pennell 5682 (C, H, K, M, P, U, Y). Pulaski: Little Maumelle, Engelmänn 407 (M). Saline —, Harvey 35 (H).

6. *Aureolaria calycosa* (Mack. & Bush) Pennell, comb. nov.

Dasystoma calycosa Mack. & Bush, in Rep. Missouri Bot. Gard. 16: 105. 1905. "Monteer, Shannon Co., Mo. Bush 219, July 31, 1899, type." Type seen.

Corolla yellow, with no tinge of purple-red. Flowering in July and August.

Stony oak-land, common in the Ozark Mountains of southern Missouri and northern Arkansas, also occurs in red loam region of northwestern, and granitic region of central Arkansas, also in sandy pineland of the Coastal Plain of eastern Arkansas.

ARKANSAS. Baxter: Cotter, E. J. Palmer 8414 (M.) Franklin: Ozark, Pennell 10620 (Y). Izard: Penters Bluff, Pennell 10676 (Y). Jefferson: Jefferson Springs, Pennell 10664 (Y). Pulaski: Little Maumelle; Little Rock, Pennell 5679 (C, H, M, P, U, Y), 10645 (Y). Saline —, Harvey 35 (H). White: Bald Knob, Biltm. Herb. 2827 (U).

25. *AGALINIS* Rafinesque.

Agalinis Raf., New Fl. Amer. 2: 61. 1837.

Type species, *A. palustris* Raf., of the Atlantic seaboard.

Capsule oblong to ovoid-oblong. Calyx-lobes 3–8 mm. long, Corolla pubescent within in a narrow line below posterior sinus.

Leaves lanceolate to lance-acuminate, entire or some trifid at base, slightly scabrous above, 2–6 mm. wide. Pedicels 2–3 mm. long. Calyx-lobes as long as or longer than the tube. Corolla 25–30 mm. long, its lobes widely spreading. Anther-cells caudate or awned at distal apex, densely lanose-pubescent. Stem glabrous, and branches spreading. I. *HETEROPHYLLAE*.

1. *A. heterophylla*.

Leaves narrowly linear, entire, very scabrous above, .8–1.5 mm. wide. Pedicels 5–16 mm. long. Calyx-lobes about one half the length of the tube. Corolla 20–26 mm. long, its posterior lobes ascending-spreading. Anther-cells obtuse to acutish at distal apex, moderately lanose-pubescent. Stem scabrelous, and branches ascending. II. *ASPERAE*.

2. *A. aspera*.

Capsule globose to globose-obovoid. Calyx-lobes less than the length of the tube.

Corolla with lobes all spreading, pubescent within at base of posterior lobes.

Seeds dark-brown. Plants tending to blacken in drying.

Calyx-tube not decidedly reticulate-venose.

III. PURPUREAE.

Inflorescence of elongated normal racemes; the pedicels less than 12 mm. long. Corolla pubescent within over nearly entire width of basal portions of posterior lobes.

Leaves and calyx-lobes obtuse to acutish. Anther-cells obtuse to acutish at distal apex. Plant fleshy, bushy-branched below and with elongated racemes above. Pedicels 5-12 mm. long. 3. *A. spiciflora*.

Leaves and calyx-lobes acute to acuminate. Anther-cells mucronate to caudate at distal apex. Plants not fleshy, more uniformly branched. Pedicels .5-5 (-8) mm. long.

Stem smooth or minutely scabrellous. Axillary fascicles not or scarcely developed, if present shorter than the leaves. Seeds .6-1.5 mm. long.

Axillary fascicles slightly developed. Pedicels 3-8 mm. long. Corolla 20-38 mm. long. Seeds .9-1.5 mm. long; areas between reticulations mostly paler and intrareticular lines discernible.

4. *A. purpurea*.

Axillary fascicles scarcely or not developed. Pedicels 2-3 mm. long. Corolla 20-25 mm. long. Seeds .9-1 mm. long; areas between reticulations nearly black and no intrareticular lines discernible.

5. *A. pinetorum*.

Stem more or less scabrous. Axillary fascicles abundantly developed, mostly equaling the leaves. Seeds .5-.8 mm. long. 6. *A. fasciculata*.

Inflorescence usually of shorter racemes (if elongated, pedicels over 10 mm. long), usually some flowers, by slower or arrested growth of stem-apex appearing nearly terminal; pedicels 5-40 mm. long.

Corolla 20-40 mm. long, pubescent within in narrow line below sinus of posterior lobes. Seeds with intrareticular areas broad, nearly hexagonal. Stigma 3-4 mm. long. Chief cauline leaves 2-3.5 cm. long, those of the branches not scale-like.

Stem scabrous. Axillary fascicles abundantly developed. Calyx-lobes minute, .1-.6 mm. long. Pedicels 25-40 mm. long. 7. *A. pulchella*.

Stem glabrous or nearly so. Axillary fascicles scarcely

or not developed. Calyx-lobes longer, triangular-lanceolate or -subulate. Pedicels 15-30 mm. long. Corolla 25-30 mm. long, slightly upcurved, its lobes strongly ciliate. Anther-cells obtuse to acutish at distal apex. Calyx-lobes .7-1 mm. long. Leaves filiform, .3-.8 mm. wide.

8. *A. caddoensis*.

Corolla 20-25 mm. long, strongly upcurved, its lobes slightly ciliate. Anther-cells acuminate-attenuate at distal apex. Calyx-lobes 1-2 mm. long. Leaves linear, 1-3 mm. wide.

9. *A. strictifolia*.

Corolla 15-22 mm. long, pubescent within over entire width of basal portions of posterior lobes. Seeds with intrareticular areas elongated, narrow. Stigma 2 mm. long. Chief cauline leaves .5-1 cm. long, those of the branches scale-like.

10. *A. oligophylla*.

Seeds yellowish-brown. Plants not tending to blacken in drying. Calyx-tube evidently reticulate-venose. Racemes little elongated, and some flowers appearing terminal.

IV. ERECTAE.

Corolla 12-18 mm. long pink, with prominent red spots within. Stigma 2-3 mm. long. Capsule globose to globose-ovoid, brown, 4-5 mm. long. Seeds rounded and turgid. Calyx-lobes .5-1.8 mm. long. Pedicels 8-30 mm. long. Plant divaricately and relatively evenly branched.

11. *A. gattingeri*.

Corolla 8-12 mm. long, pale-pink, with faint spots within. Stigma 1 mm. long. Capsule globose-obovoid, light-brown, 5-6 mm. long. Seeds angled, not turgid. Calyx-lobes 1.5-2 mm. long. Pedicels 5-22 mm. long. Plant widely branched, the primary branches long and laxly ascending.

12. *A. viridis*.

Corolla with posterior lobes arched or flattened over stamens and style, the anterior lobes spreading.

V. TENUIFOLIAE.

Posterior corolla-lobes over one half length of anterior, concave-arched. Stem nearly or quite glabrous. Axillary fascicles not or but moderately developed.

Corolla 20-23 mm. long, pubescent within in narrow line below posterior sinus. Seeds nearly black, with reticulations firm and enclosing nearly hexagonal sunken areas; intrareticular lines none. Leaves scabro-roughened to nearly glabrous above.

Calyx-lobes .1-4 mm. long, triangular-subulate to subulate.

13. *A. edwardsiana*.

Calyx-lobes .6-1 mm. long, triangular to triangular-acuminate.

13a. *A. edwardsiana glabra*.

Corolla 10-23 mm. long, glabrous within below posterior

sinus. Seeds brown, with reticulations firmer and enclosing broad, angular, not sunken spaces; intrareti-
cular lines fine. Leaves somewhat scabrous above.

Corolla 15-23 mm. long. Calyx-lobes .2-1 mm. long.

14a. *A. tenuifolia leucanthera*.

Corolla 10-15 mm. long. Calyx-lobes (.5-)1-2 mm. long.

Branches spreading. Leaves slightly scabrous above
spreading. Axillary fascicles slightly or not develop-
ed. Filaments lanate. Anther-cells densely lanose.

14b. *A. tenuifolia macrophylla*.

Branches ascending. Leaves slightly to decidedly
scabrous above, ascending. Axillary fascicles relative-
ly conspicuously developed. Filaments somewhat lan-
ate to glabrous. Anther-cells sparingly to moderately
lanose.

14c. *A. tenuifolia parviflora*.

Posterior corolla-lobes less than one half length of anterior,
flattened-ascending, the corolla 23-27 mm. long, pubes-
cent within a narrow line below posterior sinus. Stem
scabrellous. Axillary fascicles conspicuously developed.

15. *A. homalantha*.

1. *Agalinis heterophylla* (Nutt.) Small.

Gerardia heterophylla Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1834.

"Hab. In the prairies of the Arkansas, near Great Salt River," Oklahoma.

Type probably a specimen seen in Herb. Columbia University, labeled
"Arkansas, Nuttall, *Gerardia trifida*."

Gerardia crustata Greene, Leaflets Bot. Obs. & Crit. 2: 108. 1910. "Sap-
ulpa, Indian Territory, 21 Sept. 1894, collected by B. F. Bush. Type
specimens in my herbarium." Type, Bush 417, seen in Herb. Greene, now
at the University of Notre Dame. It is the prevalent form with leaves
all entire.

Agalinis heterophylla (Nutt.) Small; Britton & Brown, Ill. Fl. N. Un. St. &
Can. ed. II. 3: 209. 1913.

Corolla pale-pink, with two yellow lines and many diffused small
purple-red spots within throat anteriorly. Flowering from late
August to early October.

Sandy or sandy loam, or rarely black calcareous soil, prairie or
occasionally pineland, southeastern Missouri and northeastern
Oklahoma to southwestern Louisiana and southeastern Texas.
Chiefly on the Coastal Plain: most frequent in the coastal prairie
and on the edge of the salt-marshes, less frequent to occasional
through the short-leaf pine belt and on alluvial soils to southeastern
Missouri, and occasional in the black calcareous prairie of central
Texas; inland locally frequent in the sandy prairies of eastern
Oklahoma.

ARKANSAS. Lincoln: Varner, Bush 132 (M, U, Y). Pulaski:
Little Rock, Hasse (Y).

OKLAHOMA. Cleveland: Norman, Emig 338 (U). Craig: Vinita, Bush 416 (M). Creek: Sapulpa, Bush 417 (H, M, U, Y). Sequoyah: Blunt, E. Palmer (U).

LOUISIANA. Caddo: Shreveport, Pennell 5663 (L, M, P, Y). Calcasieu: Lake Charles, Pennell 5618 (P, U). Cameron: Cameron, Cocks 3110 (H).

TEXAS. Austin: Industry, H. Wurzlów (I). Brazoria: Brazoria; Columbia, Bush 290 (M). Colorado: Alleyton, Pennell 5559 (A, C, H, P, U, Y); Columbus; Eagle Lake, Pennell 5547 (A, C, H, L, M, P, U, Y). Dallas: Dallas, Reverchon 712 p. p. (H, M, U). Galveston: Galveston Id., Pennell 5571 (A, C, H, J, K, L, M, P, U, Y). Harris: Brookline, Pennell 5566 (P, U); Harrisburg, Pennell 5578 (A, C, H, P); Webster, Pennell 5569 (H, M, P, U). Matagorda; Van Vleck, Pennell 5506 (I, P, U). Navarro: Corsicana, Reverchon 3224 p. p. (M). Orange: Orange, Pennell 5611 (A, C, H, I, J, M, P, U, Y). Robertson: Hearne, Pennell 5420 (A, C, M, P, U, Y). Tarrant: Fort Worth, Ruth 72 (C); Handley. Travis: Austin, Young (T). Upshur: Big Sandy, Reverchon 3223 p. p. (M). Victoria: Victoria, Pennell 5502 (A, C, H, J, K, L, M, P, S, T, U, Y).

2. *Agalinis aspera* (Dougl.) Britton.

Gerardia aspera Dougl.; Benth., in DC. Prod. 10: 517. 1846. "In America boreali centrali, in planitie Red River (Douglas!) " Type, collected by Douglas in Manitoba in 1827, not verified, but certainly the species here considered.

Agalinis aspera (Dougl.) Britton; Britton & Brown, Ill. Fl. N. Un. St. & Can. ed II. 3: 209. 1913.

Corolla pale-pink, with two yellow lines and many diffused small purple-red spots within throat anteriorly. Flowering in August.

Prairies of central Oklahoma, south to Kiowa County. Through the great Plains north to South Dakota, Manitoba and Illinois.

OKLAHOMA. Alfalfa: Carwile, Ward 45 (U, Y). Kay: Tonkawa, Barker (C). Kiowa: Snyder, Eggert (M). Payne: Stillwater, Waugh 215 (M, U).

3. *Agalinis spiciflora* (Engelm.) Pennell.

Gerardia maritima grandiflora Benth., in Compan. Bot. Mag. 1: 208. 1836. "Texas, Drummond, 1st. coll." Type, in Kew Herbarium, verified by Dr. N. E. Brown as agreeing with my number 4702 from Florida; isotype seen in Herb. of Columbia University.

Gerardia spiciflora Engelm., in Boston Jour. Nat. Hist. 5: 227. 1845. New name for *Gerardia maritima grandiflora* Benth.

Agalinis spiciflora (Engelm.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 277. 1920.

Corolla pink, with two yellow lines and many small purple-red spots within throat anteriorly. Flowering from March to September.

Salt marshes, along the Gulf Coast west to Galveston Island, Texas. Along the Atlantic and Gulf coasts from North Carolina to Texas, and on the Bahaman, Cuban, and Yucatan coasts.

LOUISIANA. Jefferson: Grand Isle, Langlois (N). Terre Bonne: Timbalier Id., E. C. Wurzlów (Y).

TEXAS. Galveston: Galveston Id., Lindheimer 141 (H, M).

4. *Agalinis purpurea* (L.) Pennell.

Gerardia purpurea L., Sp. Pl. 610. 1753. "Habitat in Virginia, Canada."

Linnean diagnosis includes both long- and short-pediceled plants so could include all pink ("purple") flowered species. The first citation accompanied by a figure, Plukenet's *Digitalis virginiana rubra, foliis & facie Antirrhini vulgaris*, evidently the prevalent plant of the Atlantic seaboard, is considered as the type.

Agalinis purpurea (L.) Pennell, in Bull. Torr. Bot. Club 40: 126. 1913.

Corolla rose-pink, with two yellow lines and many diffused small purple-red spots within throat anteriorly. Flowering from July to September.

Moist sandy soil, mostly along rivers, in short-leaf pine belt of the Coastal Plain of Arkansas, Louisiana and eastern Texas, and probably in heavier soils entering the long-leaf pineland (where in lighter soils it is replaced by *A. pinetorum* Pennell). Ranges from Massachusetts to Minnesota, south to Florida and Texas.

ARKANSAS. Jefferson: Pine Bluff, Pennell 5683 (A, C, H, L, M, P, U, Y). Pulaski: Little Rock, Hasse (Y).

LOUISIANA. Boissier: Alden Bridge, Trelease (M). Ouachita: Sicard, E. J. Palmer 8927 (M). Rapides: Alexandria, Cocks (L).

TEXAS. Harris: Houston, Hall 418 p. p. (I). Smith: Tyler, Reverchon (M). Van Zandt: Grand Saline, Reverchon 2112 p. p. (M, U, Y).

5. *Agalinis pinetorum* Pennell.

Agalinis pinetorum Pennell, in Bull. Torr. Bot. Club 40: 424. 1913. "Type, St. Marks, Wakulla Co., Florida, Sept. 26, 1912, F. W. Pennell 4708, in Herb. University of Pennsylvania."

Corolla pink, with two yellow lines and diffused purple-red spots within throat anteriorly. Flowering in late September and October.

Moist soil, in long-leaf pineland and on coastal prairie, central and southern Louisiana. Ranges eastward in long-leaf pine belt to southern Georgia and northern Florida.

LOUISIANA. Calcasieu: Lake Charles, Pennell 5621 (A, C, H, J,

M, P, T, U, Y). Rapides: Pineville, Pennell 5643 (C, P), 5648 (A, H, K, L, M, P, U, Y).

6. *Agalinis fasciculata* (Ell.) Raf.

Gerardia fasciculata Ell., Sketch Bot. S. C. and Ga. 2: 115. 1822. "Grows principally in lands subject to occasional inundation from the ocean — on Edings Island near Beaufort very common." South Carolina. Type seen at the Charleston Museum.

Agalinis fasciculata (Ell.) Raf., New Fl. Am. 2: 63. 1837.

Gerardia galvesiana Greene, Pittonia 5: 138. 1903. "Galveston Id. [Texas], S. M. Tracy, 24 Sept. 1901." Type seen in Greene Herbarium now at University of Notre Dame. A rank, probably salt-marsh plant.

Gerardia langloisii Greene, Leaflets Bot. Obs. and Crit. 2: 108. 1910. "Known only as collected by the late Father Langlois in prairies near Eunice, Louisiana, 12 Sept., 1894." Type seen in Greene Herbarium. A small-flowered form.

Gerardia asprella Greene, l. c. 109. 1910. "Near St. Martinsville, Louisiana, 27 Sept., 1892, A. B. Langlois." Type seen in Greene Herbarium. A small-flowered form.

Corolla pink, with two yellow lines and many diffused purple-red spots within throat anteriorly. Flowering from August to October.

Sandy or clayey loam, especially in old fields, also in prairies and pineland; short-leaf pineland of southern Arkansas and eastern Texas; in the long-leaf pineland and coastal prairie of Louisiana and southeastern Texas (where frequently of more condensed habit and with smaller flowers = *Gerardia langloisii* and *asprella*), also west of the Ozarks in central Oklahoma and southwestern Missouri. Ranges eastward through the Coastal Plain to South Carolina.

ARKANSAS. Hempstead: Washington, Pennell 5677 (P, Y). Miller: Texarkana, Letterman (Y). Nevada: Prescott, Hollister 99 (U).

OKLAHOMA. Creek: Sapulpa, Bush 418 (H, M, U, Y), Pennell 5396 (M, P, U).

LOUISIANA. Calcasieu: Kinder, Pennell 5636 (A, H, M, P, U, Y). Rapides: Pineville, Pennell 5644 (P), 5645 (C, P, U, Y).

TEXAS. Bowie: Texarkana, Heller 4271 (A, C, H, M, U, Y). Galveston: Galveston Id., Tracy 7603 p. p. (H, N, Y). Harris: Brookline, Pennell 5565 (P); Harrisburg, Pennell 5563 (P), 5579 (P, Y); Houston, Hall 418 p. p. (H, I, M, U, Y); Sheldon; Webster, Pennell 5570 (J, K, N, P, U). Jasper: Buna, Pennell 5588 (P, U), 5604 (P). Matagorda: Van Vleck, Pennell 5511 (C, P, T). Montgomery: Conroe, Pennell 5580 (A, I, N, P), 5582 (H, M, P, Y). Navarro: Corsicana, Reverchon 3224 p. p. (M).

Orange: Orange, Pennell 5609 (P), 5610 (A, H, P, U). Panola: Beckville, Reverchon 2747(M). Polk: Livingston, E. J. Palmer 6751 (M). Robertson: Hearne, Pennell 5423 (A, C, H, M, P, U). Rusk: —, Vincent (M). Upshur: Big Sandy, Reverchon 3223 p. p. (M).

7. *Agalinis pulchella* Pennell.

Agalinis pulchella Pennell, in Bull. Torr. Bot. Club 40: 428, 1913. "Type, Ponce de Leon, Holmes Co., Florida, Sept. 17, 1912, F. W. Pennell 4658, in Herb. University of Pennsylvania."

Corolla rose-pink, with two yellow lines and relatively large purple-red spots within throat anteriorly. Flowering in September.

Open sandy long-leaf pineland, central Louisiana. Ranges eastward to southern Georgia and northern Florida.

LOUISIANA. Rapides: Glenmora, Pennell 5631 (L, M, P, U); Pineville, Pennell 5637 (A, C, H, P, U, Y).

8. *Agalinis caddoensis* Pennell, sp. nov.

Annual. Plant dull-green or purplish, tending to blacken in drying. Stem 4–6 dm. tall, slender, with many loosely ascending branches, finely striate, 4-angled above, very sparingly scabrelous. Leaves opposite, or sparingly subopposite above, spreading, filiform, entire, acuminate, strongly involute, those of the stem 2.5–3 cm. long, .8 mm. wide; bracts slightly reduced; leaves scabrous above. Axillary fascicles not developed. Racemes scarcely elongated, broken, frequently but one flower of pair developed, 1–5 flowered. Pedicels ascending-spreading, slender, sparingly scabrelous to glabrous, in flower 13–22 mm. long, equaling to slightly longer than the bracts, many on the branches appearing as terminal. Calyx-tube 4–5 mm. long, hemispheric-campanulate, obscurely 5-ribbed, truncate; its lobes .7–1 mm. long, triangular-subulate, not callose; apex of tube and lobes within evidently puberulent. Corolla (20–) 25–30 mm. long, spreading 23–28 mm. wide, membranous, its tube 19–23 mm. long, slightly upcurved, its lobes 6–7 mm. long, rounded to retuse, all spreading; externally minutely pubescent in line below posterior sinus; lobes ciliate, the posterior slightly more so; rose-pink, 2 yellow lines and many small diffused red-purple spots within throat anteriorly. Filaments flattened, posterior 7–9 mm. long, anterior 11–13 mm. long, all lanose, especially toward apex; anther-cells 3–3.5 mm. long, oblong-lanceolate, obtuse to acutish at base, lanose with white hairs on the valvular surface, glabrous on the sides. Style 11–13 mm. long, linear, pubescent. Stigma 3.5 mm. long. Capsule not seen.

Type, dry loam oakwoods along Kansas City Southern Railroad 2–3 miles northwest of Shreveport, Caddo Parish, Louisiana;

collected in flower October 5, 1913, F. W. Pennell 5653; in Herb. University of Pennsylvania; flowers in October.

Dry loam oakwoods around Shreveport, Caddo Parish, Louisiana.

LOUISIANA. Caddo: Shreveport, Pennell 5655 (A, J, L, P, U), 5658 (C, H, K, M, P, U, Y), 5665 (P).

9. *Agalinis strictifolia* (Benth.) Pennell, comb. nov.

Gerardia strictifolia Benth., in Comp. Bot. Mag. 1: 209. 1836. "Hab. Texas, Drummond, (3rd Coll. n. 294)." Type seen in Kew Herbarium. Iso-type in Herb. Academy of Natural Sciences of Philadelphia, etc.

Corolla pale purplish-pink, with two yellow lines and many dif-fused purple-red spots within throat anteriorly. Flowering from late August to early October.

Sandy soil, or more rarely black calcareous loam, Coastal Plain, from Austin and Travis to Webb counties, southern Texas. Frequent or common through the sandy southern Fayette prairie region and on the coastal prairie, less frequent inland in the black belt; in the valley of the Nueces River and on the lower Rio Grande.

TEXAS. Austin: San Felipe, Drummond 294 (A, H, K, Y). Lavaca: Hallettsville, Fisher 125 (U). Nueces: Corpus Christi, Rose 18066 (U). Travis: Austin, Pennell 5431 (A, H, J, M, P, U, Y). Victoria: Aloe, Pennell 5492 (C, L, N, P, U, Y); Victoria, Pennell 5489 (I, P, S). Webb: Rio San Pedro, etc., Schott (H).

10. *Agalinis oligophylla* Pennell.

Gerardia aphylla grandiflora Benth., in Compan. Bot. Mag. 1: 174. 1836. "Jacksonville [Drummond]." Type labeled "Jacksonville," evidently the present Jackson, Louisiana, seen in Kew Herbarium.

Gerardia plukenetii microphylla A. Gray, Syn. Fl. N. Am. 1. II: 293. 1878. "Louisiana, Drummond, Hale." Type, an isotype of *Gerardia aphylla grandiflora* Benth., seen in Gray Herbarium.

Agalinis oligophylla Pennell, in Bull. Torr. Bot. Club 40: 432. 1913. New name for *Gerardia plukenetii microphylla* A. Gray, not *A. microphylla* Raf., 1837.

Corolla rose-pink, with two yellow lines and, mostly along these, rather large purple-red spots within throat anteriorly. Flowering from late September to late October.

Sandy or somewhat clayey soil, long-leaf pineland, or more rarely prairies, southern Louisiana and southeastern Texas. Most abundant in the flat long-leaf pineland of southwestern Louisiana and southeastern Texas, less frequent or occasional on the adjacent coastal prairie. Ranges eastward to southern Mississippi.

LOUISIANA. Calcasieu: Lake Charles, Pennell 5617 (A, C, H, J, K, L, M, P, U, Y). Rapides: Glenmora, Pennell 5630 (A, C, H,

I, J, L, M, N, P, U, Y); Pineville, Pennell 5640 (A, C, H, P, S), 5647 (K, M, P, U, Y).

TEXAS. Hardin: Silsbee, Pennell 5591 (M, N, P, U). Harris: Harrisburg, Pennell 5576 (A, C, H, J, K, L, M, P, S, T, U, Y). Jasper: Buna, Pennell 5583 (A, C, H, L, N, P, S, Y). Orange: Orange, Pennell 5607 (P).

11. *Agalinis gattingeri* (Small) Small.

Gerardia tenuifolia leptophylla Benth., in Compan. Bot. Mag. 1: 174. 1836. "Jacksonville, Louisiana. Drummond." Type seen in Kew Herbarium.

Gerardia gattingeri Small, Fl. S. E. Un. St. 1078, 1338. 1903. "Type, Curtiss N. A. Pl. no. 1910* in Herb. C. U." Type, collected by A. Gattinger on hills around Nashville, Tennessee, seen in Herb. Columbia University.

Agalinis gattingeri (Small) Small, in Britton & Brown, Ill. Fl. N. Un. St. and Can. ed II. 3: 213. 1913.

Corolla pink, with two yellow lines and several to many rather large purple-red spots within throat anteriorly. Flowering from late August to mid-October.

Sandy or clayey soil, often stony, woodland, barrens or open bluffs; in the Ozark and Ouachita mountains of Arkansas and south-eastern Oklahoma; in hills of east-central Oklahoma; in the oak and short-leaf pineland of northwestern Louisiana and eastern Texas, extending nearly to coast in Harris County, Texas. Ranges from Michigan and Minnesota, south to Alabama and Texas.

ARKANSAS. Boone: Harrison, E. J. Palmer 6913 (M). Carroll: Eureka Springs, E. J. Palmer 4561 (P). Garland: Hot Springs, Pennell 5681 (P). Hempstead: Fulton, E. J. Palmer 6870 (M). Newton: Jasper, E. J. Palmer 6945 (M). Pulaski: Little Rock, Hasse (Y).

OKLAHOMA. Creek: Sapulpa, Bush 443 (M, N, U, Y). Le Flore: Canaval Mt., E. J. Palmer 9057 (M).

LOUISIANA. Caddo: Shreveport, Pennell 5656 (P, U), 5659 (C, M, N, P, Y), 5666 (A, H, I, L, P, U). Rapides: Alexandria, Hale (A, U, Y). Sabine: Sodus, Pennell 5650 (A, J, K, L, M, P, S, T, Y), 5652 (C, H, N, P, U).

TEXAS. Harris: Lynchburg, Lindheimer (M). Lamar: Paris, Heller 4219 (M, U, Y). Panola: Beckville, Reverchon 3225 (M). Polk: Livingston, E. J. Palmer 6796 (M).

12. *Agalinis viridis* (Small) Pennell, comb. nov.

Gerardia viridis Small, in Bull. Torr. Bot. Club 25: 619. 1898. "Mr. Heller . . . collected . . . specimens . . . about Texarkana, Arkansas, during the past season, no. 4240." Type seen in Herb. New York Botanical Garden.

Corolla pale-pink, with two yellow lines and faint purple-red

spots within throat anteriorly. Flowering from early September to early October.

Moist sandy pineland in the Coastal Plain; frequent or common in long-leaf pineland, rarely on coastal prairies, in southwestern Louisiana and southeastern Texas; frequent or occasional in short-leaf pineland, of northwestern Louisiana and northeastern Texas, extending through eastern Arkansas to southeastern Missouri; also on prairies of southwestern Missouri.

ARKANSAS. Jefferson: Pine Bluff, Pennell 5184 (A, C, H, J, M, P, U, Y).

LOUISIANA. Boissier: Alden Bridge, Trelease (M). Caddo: Shreveport, Pennell 5668 (A, H, L, M, P). Calcasieu: Kinder, Pennell 5625 (C, P, Y); Lake Charles, Pennell 5620 (P, S, U). Rapides: Glenmora, Pennell 5633 (A, H, L, M, N, P, U); Pineville, Pennell 5642 (P, U), 5649 (C, P, U, Y). St. Landry: Eunice, Langlois (N).

TEXAS. Bowie: Texarkana, Heller 4240 (A, C, H, I, M, U, Y). Brazoria: Columbia, Bush 1532 (M, Y). Hardin: Silsbee, Pennell 5592 (C, H, K, N, P). Harris: Harrisburg, Pennell 5577 (C, H, M, P, T, U, Y). Jasper: Buna, Pennell 5584 (A, I, J, L, P, U), 5589 (M, N, P, Y). Orange: Orange, Pennell 5606 (A, P, U).

13. *Agalinis edwardsiana* Pennell, sp. nov.

Annual. Plant dull-green or purplish, tending to blacken in drying. Stem 4-8 dm. tall, slender, with many laxly ascending-spreading branches, obscurely striate 4-angled above, nearly terete below, essentially glabrous (sparingly very minutely scabrellous near bases of branches). Leaves opposite or sparingly subopposite above, spreading, or the lower frequently somewhat reflexed, linear, entire, acuminate, those of the stem 2-3.5. cm. long, .5-.9 mm. wide; bracts gradually reduced; leaves scabro-roughened to nearly glabrous above. Axillary fascicles scarcely or not developed, when present much shorter than the subtending leaves. Racemes slightly elongated, frequently but one flower of pair developed, 2-9 flowered. Pedicels ascending-spreading, slender, filiform, glabrous, in flower 5-30 mm. long, in fruit 10-32 mm. long, 1.5 to 3 times the length of the bracts. Calyx-tube 3.5-4.5 mm. long, hemispheric, obscurely veined, rib-veined, $\frac{3}{5}$ - $\frac{2}{3}$ the length of the capsule, truncate, its lobes .1-.4 mm. long, triangular-subulate to subulate, acuminate; apex of tube and lobes within granular-puberulent. Corolla 20-23 mm. long, spreading 18-20 mm. wide, membranous; its tube 12-14 mm. long, straight; its lobes, posterior 5-6 mm. long, anterior 8-9 mm. long, all erose to emarginate, anterior spreading, posterior broadly arched over stamens and style; exter-

nally mostly glabrous, sparingly minutely pubescent below sinuses of lobes, within slightly pubescent about bases of filaments and in narrow line below posterior sinus; lobes all ciliate; rose-pink, 2 yellow lines and many small diffused sharply-defined red-purple spots within throat anteriorly. Filaments flattened, posterior 6 mm. long, anterior 9-10 mm. long, posterior lanose-pubescent near base, glabrous distally, becoming slightly lanose-pubescent toward apex, anterior lanose throughout; anther-cells 3-3.3 mm. long, lanceolate, cuspidate at base, scarcely muriculate, very densely lanose with white hairs on the valvular surface, glabrous on the sides. Style 13-15 mm. long, filiform-linear, pubescent to glabrous. Stigma 1-1.5 mm. long. Capsule 6-7 mm. long, globose to obovoid-globose, dark-brown. Seeds 1.1-1.3 mm. long, broadly lunate-triangular to ovoid, narrower than broad, irregular, rounded; testa dark-brown to nearly black, with reticulations firm, nearly or quite black, enclosing broad, nearly hexagonal, angular, sunken spaces (honeycomb appearance); intrareticular lines not evident.

Type, dry adobe hills, 5 miles northeast of Boerne, Kendall County, Texas, collected in flower September 16, 1913, F. W. Pennell 5482; in Herb. University of Pennsylvania.

Thin soil over limestone, adobe soil, Edwards Plateau of Central Texas. Flowering in September.

TEXAS. Bexar: Comanche Spring, Lindheimer 149 (A, C, H, M, P, U, Y). Gillespie: Three Mill Creek, Jermy 754 p. p. (M, U); Williams Creek. Kendall: Boerne, Pennell 5482 (A, C, H, J, K, L, M, P, S, U, Y), 10417 (Y). Kerr: Kerrville, Pennell 10369 (A, C, T, U, Y). Travis: Austin, Pennell 10454 (H, M, P, Y), Tharp (T).

13a. *Agalinis edwardsiana glabra* Pennell, var. nov.

Stricter, Calyx-lobes .6-1 mm. long, triangular to triangular-acuminate. Mature capsule not seen. Otherwise as in the species.

Type, arroyos, Devils River, Texas, collected in flower, C. C. Parry (Mexican Boundary Survey 784); in United States National Herbarium.

Arroyos, western Edwards Plateau, Texas.

TEXAS. Valverde: Devils River, Parry (Mex. Bound. Surv. 784), (H, U).

14. *Agalinis tenuifolia* (Vahl) Raf.

Gerardia tenuifolia Vahl, Symb. Bot. 3: 7. 1794. "Habitat in America septentrionali." Type in Herb. Universitetets Botaniske Museum, Copenhagen, Denmark, collected by Von Rohren, and said to be probably from Philadelphia, is identified by Dr. C. H. Ostenfeld as agreeing with my number 2681 from Pennsylvania.

Agalinis tenuifolia (Vahl) Raf., New Fl. Am. 2: 64. 1837..

Corolla purplish-pink, with two yellow lines and small diffused purple-red spots within throat anteriorly.

The typical form, with small corollas and minute calyx-lobes, a plant widespread in the eastern United States and which passes into each of the following varieties, is scarcely or not represented in our area. Possibly the following collection should be assigned to it:

ARKANSAS. Miller: Texarkana, Pennell 5671 (P, U).

14a. *Agalinis tenuifolia leucanthera* (Raf.) Pennell.

Gerardia leucanthera Raf., Fl. Ludov. 50. 1817. Louisiana. C. C. Robin.

No type known to exist.

Agalinis tenuifolia leucanthera (Raf.) Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 286. 1920.

Usually in moist soil, loam or clay, rarely in sand, woodland or meadow, especially near streams, in the Coastal Plain of Louisiana and eastern Texas. Ranges eastward through the Coastal Plain to southern Georgia and northern Florida. Eastward passes into the species.

LOUISIANA. Caddo: Shreveport, Pennell 5657 (P), 5660 (P, U), 5661 (A, H, K, L, M, P, Y), 5664 (C, J, P), 5669 (P, S). Calcasieu: Lake Charles, Pennell 5616 (C, H, L, P, U, Y); West Lake, Pennell 5612 (A, M, N, P, U) Concordia: —, Smith (H). Rapides: Alexandria, Hale (L, Y).

TEXAS. Bowie: Texarkana, Pennell 5673 (P), 5676 (P, T). Harrison: Marshall, E. J. Palmer 6860 (M). Orange: Orange, Pennell 5608 (P). Van Zandt: Grand Saline, Reverchon 2112 p. p. (M).

14b. *Agalinis tenuifolia macrophylla* (Benth.) Blake.

Gerardia tenuifolia macrophylla Benth., in Compan. Bot. Mag. 1: 174. 1836.

"St. Louis, Jacksonville." T. Drummond. Fragment of type labeled

"St. Louis," from Kew Herbarium, seen.

Gerardia besseyana Britton, in Mem. Torr. Bot. Club 5: 295. 1894. New name for *Gerardia tenuifolia macrophylla* Benth., not *G. macrophylla* (Nutt.) Benth.

Agalinis tenuifolia macrophylla (Benth.) Blake, in Rhodora 20: 71. 1918.

Moist to dry loam or clay soil, in deciduous woodland, usually along streams, in and near the Ozark and Ouachita hills, and the hills of east-central Oklahoma. Ranges from southern Ontario to Minnesota, south to northern Alabama and eastern Oklahoma. Eastward passes into the species and westward into the following variety.

ARKANSAS. Cleburne: Heber Springs, E. J. Palmer 6985 (M).

Hempstead: Fulton, Bush 1065 (M, U, Y). Nevada: Prescott, Hollister 65 (U). White: Bald Knob, Biltm. Herb. 477 (U).

OKLAHOMA. Cherokee: ———, Woodhouse (H). Creek: Sapulpa, Bush 421 (M).

14c. *Agalinis tenuifolia parviflora* (Nutt.) Pennell, comb. nov.

Gerardia tenuifolia parviflora Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1837.

"In the prairies of the Arkansas above the Verdigris River." Oklahoma.

T. Nuttall. Type, labeled "Ark.," seen in Herb. Academy of Natural Sciences of Philadelphia.

Moist soil, prairies near rivers, Great Plains of northern Oklahoma. Ranges from Michigan and North Dakota to Oklahoma and eastern Colorado. Eastward intergrades with the preceding variety.

OKLAHOMA. Alfalfa: Cherokee [Outlet], Carleton 439 (U). Wagoner (?): prairies above Verdigris River, Nuttall (A).

15. *Agalinis homalantha* Pennell, sp. nov.

Gerardia longifolia Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1834. "Hab. on the banks of the Arkansas." T. Nuttall. Type seen in Herb. Academy of Natural Sciences of Philadelphia. Not *Agalinis longifolia* Raf., 1837.

Annual. Plant green or purplish, tending to blacken in drying. Stem 4–7 dm. tall, slender, with many ascending-spreading branches, scarcely striate-angled, slightly scabrellous. Leaves opposite, slightly subopposite above, spreading, linear, entire, acuminate, those of the stem 2.5–3 cm. long, 1–1.5 mm. wide; bracts gradually reduced; leaves somewhat scabrous above. Axillary fascicles strongly developed, shorter than the subtending leaves. Racemes elongated, frequently but one flower of pair developed, 4–10 flowered. Pedicels ascending-spreading, slender, filiform, slightly scabrellous, in flower 10–20 mm. long, in fruit reaching at least 20–27 mm. long, 1.5–2.5 times the length of the bracts. Calyx-tube 3–3.5 mm. long, broadly campanulate (in flower), scarcely rib-veined, truncate, its lobes 1–1.2 mm. long, lanceolate, acuminate; apex of tube and lobes within densely puberulent. Corolla 23–27 mm. long, spreading 21–25 mm. wide, membranous; its tube 15–18 mm. long, straight; its anterior lobes 8–9 mm. long, posterior 3–4 mm. long, all slightly rounded to truncate, anterior spreading, posterior scarcely or not arched, flat-extended over stamens and style; externally pubescent, especially distally, within slightly pubescent about bases of filaments, pubescent in line below posterior sinus; lobes all conspicuously ciliate; rose-pink, 2 yellow lines and many small diffused purple-red spots within throat anteriorly. Filaments flattened, posterior 5–6 mm. long, anterior 7–8 mm. long, all lanose, very densely so toward apex; anther-cells 3–3.5 mm. long, lanceolate, cuspidate at base, very densely lanose with tortuous white hairs on the valvular surface, glabrous on the sides. Style 12–14 mm. long,

filiform-linear, slightly pubescent. Stigma 1.5-2 mm. long. Capsule not seen.

Type, sandy oakwoods, along San Antonio and Arkansas Railroad, about one mile west of Sheridan, Colorado County, Texas, collected in flower September 21, 1913, F. W. Pennell 5522; in Herb. University of Pennsylvania.

Sandy soil, post oak-woods, Fayette zone of central southeastern Texas, northward in cross-timbers to the hills of southern Oklahoma and the Arkansas River, certainly rare or local. Flowering in September.

OKLAHOMA. Johnston: Tishomingo, E. J. Palmer 6494 (M). —: Arkansas River, Nuttall (A).

TEXAS. Austin: San Felipe, Drummond 217 (H, Y). Colorado: Sheridan, Pennell 5522 (C, H, L, M, P, U, Y). Dallas: Oak Cliff, Reverchon (M). Harris: Houston, Hall (M). Waller: Hempstead, Hall (I) [differs by calyx-lobes apparently abnormally long, 5-6 mm. long].

26. **OTOPHYLLA**⁹ Benth.

Otophylla Benth., in DC. Prod. 10: 512. 1846.

Type species, *Gerardia auriculata* Michx.

Leaf-blades lanceolate to broadly lanceolate, upper auricled at base; scabrous above. Spikes little crowded. Calyx-tube over one-half capsule length, retrorse-pubescent. Corolla 20-23 mm. long. Style pubescent. Capsule 10-13 mm. long, broadly ovate. Seeds slightly angled. *O. auriculata*.

Leaf-blades bipinnatifid, segments linear or nearly so; nearly glabrous above. Spikes densely crowded. Calyx-tube less than one-half capsule length, minutely scabrellous to glabrate. Corolla 23-32 mm. long. Style glabrous. Capsule 8-10 mm. long, ovate-oblong. Seeds sharply angled. *O. densiflora*.

1. **Otophylla auriculata** (Michx.) Small.

Gerardia auriculata Michx., Fl. Bor. Am. 2: 20. 1803. "In pratis regionis Illinoensis [A. Michaux.]" Type not verified, but description distinctive.

Otophylla auriculata (Michx.) Small, Fl. S. E. Un. St. 1075, 1338. 1903.

Corolla rose-pink, with many rather small purple-red spots within throat anteriorly. Flowering in August and September.

Moist to dry prairies, old fields, apparently native from Michigan to southern Minnesota and northwestern Arkansas; introduced in the northeastern states, but whether introduced or native in northeastern Texas is uncertain.

⁹ For discussion of generic name see Bull. Torr. Bot. Club 40: 126. 1913, and Torreya 19: 215-16. 1919.

ARKANSAS. "N. W. Ark.," Harvey 11 (H).

TEXAS. Tarrant: Benbrook, Reverchon 3937 (M, Y).

2. *Otophylla densiflora* (Benth.) Small.

Gerardia densiflora Benth., in Compan. Bot. Mag. 1: 206. 1837. "Texas. Drummond." Isotype, Drummond 218, seen in Herb. Columbia University.

Otophylla densiflora (Benth.) Small, Fl. S. E. Un. St. 1075, 1338. 1903.

Dry sterile or stony prairies and bluffs, especially calcareous, central Oklahoma south to the hills of central Texas (eastern Edwards Plateau). Ranges northward to central Kansas. Flowering in August and early September.

OKLAHOMA. Alfalfa: Cherokee [Outlet], Carleton 470 (I, U). Cleveland: —, P. J. White (R). Logan: —, Carleton 728 (O, R). Payne: —, Olive 142 (Y).

TEXAS. Bexar: Comanche Spring, Lindheimer 112 (A, C, H, M, P, U, Y). Blanco: Blanco, — (M). Comal: New Braunfels, Lindheimer 379 (A, C, H, M, P, U, Y). Dallas: Dallas, Reverchon 1198 (C, M, P, U). Hood: Granbury, E. J. Palmer 6556 (M).

27. **BUCHNERA** Linné.

Buchnera L., Sp. Pl. 630. 1753.

Type species, *B. americana* L.

Leaves 3-9 cm. long, lanceolate to ovate-lanceolate, relatively coarsely dentate. Corolla-lobes 6-9 mm. long, the tube 2-2½ times the length of the calyx. Capsule 8-9 mm. long, oblong. Stem hirsute-pubescent.

1. *B. americana*.

Leaves 2-7 cm. long, prevailing lanceolate-elliptic, mostly obtuse, entire or the lower slightly dentate. Corolla-lobes usually 4-6 mm. long, the tube mostly 1-1½ times the length of the calyx. Capsule 5-6.5 mm. long, ovate. Stem less pubescent or even glabrate.

2. *B. elongata obtusa*.

1. *Buchnera americana* L.

Buchnera americana L. l.c. 630. 1753. "Habitat in Virginia, Canada."

Based upon Gron., Fl. Virg. 74. 1743, typified by Clayton 142 from Virginia. Description sufficiently distinctive.

Corolla purplish-blue throughout. Flowering from June to September; and soon ripening fruit.

Sandy or loam soil, prairies and barren knolls or open woodland of western Arkansas and eastern and central Oklahoma; southward into the Coastal Plain of Louisiana and eastern Texas (where leaves are smaller and more entire, and the plant probably intergrades with *B. elongata obtusa* Pennell). Ranges from Pennsylvania to southern Ontario and Illinois, south to Florida and Texas.

- ARKANSAS. Sebastian: Fort Smith, Bigelow (U, Y).
 OKLAHOMA. Alfalfa: Cherokee [Outlet], Carleton 477 (U).
 Bryon: Colberts, Sheldon (Y). Caddo (?): ———, E. Palmer
 221 (U, Y). Payne: Ingalls, Waugh 18 (U).
 LOUISIANA. ———, Hale (Y).
 TEXAS. Jasper: Buna, Pennell 5587 (P).

2. *Buchnera elongata obtusa* Pennell.

Buchnera elongata obtusa Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 288, 1920. "Type, open sandy pineland, 1-2 miles north of Abita Springs, St. Tammany Parish, Louisiana, collected in flower and fruit August 14, 1912, F. W. Pennell 4190, in Herb. New York Botanical Garden."

Corolla purplish-blue or violet-purplish throughout. Flowering from May to October, and soon ripening fruit.

Sandy soil, long-leaf pineland and adjacent coastal prairie of southern Louisiana and southeastern Texas; westward to oak-woods of Colorado county, Texas. Ranges eastward in the Coastal Plain to North Carolina.

LOUISIANA. Calcasieu: Lake Charles, Allison 251 (U, Y). Jeff Davis: Jennings, Pennell 10207 (L, M, Y). Rapides: Alexandria, Hale (Y).

TEXAS. Colorado: Sheridan, Pennell 5521 (P, Y). Hardin: Silsbee, Pennell 5590 (P, Y). Waller: Hempstead, Hall 417 (U, Y). Wichita: Burkburnett, Tharp 604 (Y).

28. *SCHWALBEA* Linné.

Schwalbea L., Sp. Pl. 606. 1753.

Type species, *S. americana* L., of Virginia.

1. *Schwalbea australis* Pennell.

Schwalbea australis Pennell, in Proc. Acad. Nat. Sci. Phila. 71: 289. 1920. "Type, damp pine barrens near Seville, Volusia County, Florida, collected in flower May 10, 1900, A. H. Curtiss 6742; in Herb. New York Botanical Garden."

Sandy soil, rather moist, oakland and pineland, in central Louisiana. Ranges through the Coastal Plain from South Carolina to central Florida and Louisiana. Flowering in May.

LOUISIANA. Rapides: Alexandria, Hale (Y), Cocks (L).

29. *CASTILLEJA* Mutis.

Castilleja Mutis; L. f., Suppl. 293. 1781.

Type species, *C. fissifolia* L. f., of Colombia.

Root perennial. Sepals not expanding distally. Seeds with heavier reticulations enclosing relatively hexagonal areas. Stems white-tomentose or -lanate.

Sepals of each side distally free. Posterior lobes of corolla with narrow membranous margins, anterior lobes relatively developed (over one third length of posterior) and distally thin. Leaf-blades pinnatifid-lobed, and like the calyx more or less pubescent.

Corolla 40-50 mm. long. Sepals attenuate, acutish to acute.

Capsule 15 mm. long. Stem tomentose. Bracts and calyx distally yellowish.

1. *C. sessiliflora*.

Corolla shorter. Sepals broader. Capsule 10-13 mm. long. Stem appressed-lanate.

Corolla 35-40 mm. long, its anterior lobes 5-7 mm. long, yellow and much longer than the slightly thickened green base. Sepals acute to acuminate. Stigma about 1 mm. wide. Leaves 3-7 cm. long. Bracts and calyx yellowish.

2. *C. labiata*.

Corolla 30-35 mm. long. Seeds 1.5-1.8 mm. long, brown. Leaves 5-8 cm. long.

Anterior corolla-lobes 5-7 mm. long, purple, evidently longer than the thickened green base. Sepals acutish or acute. Bracts and calyx distally violet-purple. Stigma nearly 1 mm. wide.

3. *C. purpurea*.

Anterior corolla-lobes 3-4 mm. long, pinkish, little if at all longer than the thickened green base. Sepals obtuse. Bracts and calyx distally orange-red. Stigma about .5-.7 mm. wide.

4. *C. lindheimeri*.

Corolla 18-23 mm. long. Seeds 1.2 mm. long, blackish-brown. Leaves 3-6 cm. long. Bracts and calyx distally lemon-yellow.

5. *C. citrina*.

Sepals of each side united throughout, broadly rounded. Posterior lobes of corolla with broad membranous margins, anterior lobes green, thickened nearly throughout, and less than one fourth length of posterior. Leaf-blades entire.

Stems, leaves and calyces densely white-lanate. Leaves linear; the bracts usually trifid.

6. *C. lanata*.

Stem, leaves and calyces finely pubescent, green. Leaves oblong-lanceolate; the bracts broad, entire.

7. *C. latebracteata*.

Root annual. Sepals of each side united throughout, expanding distally to the broadly rounded apex. Seeds with lighter pale-brown reticulations enclosing slightly elongated areas. Bracts and calyx distally red. Stem loosely pubescent.

Anterior corolla-lobes developed, distally thin, yellowish. Leaf-blades pinnatifid-lobed. Plant forming a flat basal rosette of leaves, which persist until after anthesis.

8. *C. coccinea*.

Anterior corolla-lobes very short, thickened, green. Leaf-blades entire or occasionally slightly pinnatifid-lobed. Basal rosettes less definitely formed, not persisting.

9. *C. indivisa*.

1. *Castilleja sessiliflora* Pursh.

Castilleja sessiliflora Pursh, Fl. Am. Sept. 738. 1814. "In upper Louisiana. Bradbury. . . . v.s. in Herb. Bradbury." Imperfectly described. Better characterized by Nuttall, who knew the plant growing, as *Euchroma grandiflora*, Gen. N. Am. Pl. 2: 55. 1818.

Corolla yellowish-green, the posterior lip pink-margined, the anterior yellowish-white and only slightly greenish-thickened at base. Bracts and calyx distinctly yellowish. Flowering in May and June.

Sandy or rocky plains and bluffs, escarpments of the Staked Plains of northwestern Texas; Upper Sonoran Zone (at altitudes above 1500 meters). Through the Great Plains from Illinois and Manitoba to Wyoming and northwestern Texas.

TEXAS. Hall: Estelline, Reverchon 4316 (M, U, Y). Randall: Canyon, Pennell 10542 (A, H, M, O., T, U, Y).

2. *Castilleja labiata* Pennell, sp. nov.

Root perennial. Stems several, 1.5—2 dm. tall, arachnoid-lanate with close pubescence. Leaves 3–7 cm. long, linear to lanceolate, slightly 3-ribbed, trifid, with narrow lobes, finely cinereous-pubescent especially on the lower surface, green above, paler beneath. Bracts broader, conspicuously trifid, probably distally yellowish or greenish-yellow. Sepals 22–25 mm. long, those of each side united $\frac{2}{3}$ length, acutish to acuminate, puberulent, apparently yellowish. Corolla 35–40 mm. long; posterior lip 10–12 mm. long, with thin margins; anterior 5–7 mm. long, proximally deep-green, distally flaring, evidently yellow or yellowish; anterior lobes glandular-pubescent, posterior with longer glandless hairs. Stigma about 1 mm. wide. Capsule not seen.

Type, stony prairie (uncommon), San Angelo, Texas, collected in flower May 19, 1899, W. L. Bray 353, in United States National Herbarium; isotype in Herb. University of Texas.

I regret that the spring of 1920 had been so dry, and consequently so early, that on my visit to San Angelo on May 18 and 19, all *Castillejas* were in fruit and shriveled. I failed to find this species, but the plant I did find and which appeared to be common proved to be *C. citrina*, below. Though disliking to base a species of this critical genus on so few collections, I think *C. labiata* must be recognized. It appears to be a primitive member of the alliance of *C. purpurea* (Nutt.) G. Don, connecting that group with *C. sessiliflora* Pursh.

TEXAS. Tom Green: San Angelo, Bray 353 (T, U). Valverde: Devil's River, Pilsbry (A).

3. *Castilleja purpurea* (Nutt.) G. Don.

Euchroma purpurea Nutt., in Trans. Am. Phil. Soc. II. 5: 180. 1837.
 "Hab. On rocks in the hilly prairies of Red River [Arkansas Territory.
 T. Nuttall]" Type seen in Herb. Academy of Natural Sciences of Philadelphia.

Castilleja purpurea (Nutt.) G. Don, Gen. Hist. 4: 615. 1838.

Rocky prairies and bluffs, especially calcareous, in the Grand and Black Prairies and adjacent hills, southeastern Oklahoma and north-eastern Texas; also in the prairies of the Verdigris River in north-eastern Oklahoma. Flowering in April and May, and soon ripening fruit.

OKLAHOMA. Atoka: Limestone Gap, G. D. Butler 30 (U).
 McCurtain: Idabel, Houghton 3681 (M). Rogers: Catoosa, Bush 1048 (M, Y).

TEXAS. Dallas: Dallas, Reverchon 714 (M, P, U). Hood: Granbury, Eggert (M, U, Y). Tarrant: Texas Christian Univ., Ruth 371 (U, Y).

4. *Castilleja lindheimeri* A. Gray.

Castilleja lindheimeri A. Gray, Syn. Fl. N. Am. 2. 1: 298. 1878. "Stony or fertile mountain prairies, on the Piedernales and Guadalupe, W. Texas. Lindheimer, &c." Type not seen, but description distinctive.

Corolla whitish-green, the posterior lip with orange-red margin, the anterior pinkish-red and green-thickened at base. Bracts and calyx distally orange-red. Flowering in April and May, and soon ripening fruit.

Gravelly or rocky calcareous soil, prairies or hills, from Parker and Tom Green (or Martin) to Hays and Uvalde counties, Texas. Common on the hills of the Edwards Plateau, on the Lampasas Plain and in the Coleman and Concho districts, Lower Sonoran Zone (at altitudes of 500 to 2,000 feet).

TEXAS. Bexar: Camp Stanley Inc., Pennell 10414 (T, Y). Blanco: Blanco, E. J. Palmer 13290 (M). Coleman: Coleman, Reverchon 117 (M). Comal: Fischer Store, E. J. Palmer 12189 (M). Comanche: Comanche, Eggert (M). Gillespie: Nibo Mt., Jermy 279 (M, U). Hays: San Marcos, Pennell 10431 (A, C, H, K, M, T, U, Y). Hood: Granbury, Eggert (M). Kendall: Boerne, Pennell 10421 (P, Y). Kerr: Kerrville, Heller 1630 (A, M, U, Y), Pennell 10364 (A, H, L, M, T, Y), 10396 (J, O, S, U, Y); Laceys Ranch; Turtle Creek. [? Martin:¹⁰ Stanton, Eggert (M).]

¹⁰ Martin: Stanton (prairies n.) H. Eggert, collected in flower and fruit June 13, 1900 (M).

Plant 3.5 dm. tall, in fruit and late flower. Faded and with broken short

Medina: Hondo, Pilsbry (A). Menard: Menard, E. J. Palmer 11876 (bracts yellow) (M). Parker: —, N — (M, U). Tom Green: San Angelo, Reverchon 3932 (M, U). Travis: Austin, Pennell 10437 (U, Y).

5. *Castilleja citrina* Pennell, sp. nov.

Root perennial. Stems several, 1-3 dm. tall, arachnoid-lanate with close pubescence. Leaves 3-6 cm. long, narrow, 3-ribbed, trifid, with narrow falcate lobes loosely or finely cinereous-pubescent, pale. Bracts broader, conspicuously trifid, distally lemon-yellow. Sepals 18-20 mm. long, those of each side united less than one third length, all obtuse, puberulent, distally lemon-yellow. Corolla 18-23 mm. long; posterior lip 9-10 mm. long, deep-green with pale-yellow thin margins; anterior 3-4 mm. long, proximally deep-green, distally flaring, pale-yellow; all lobes glandular-pubescent, the posterior with longer hairs. Stigma about .7 mm. wide. Capsule 10-12 mm. long, ovoid in outline, brown. Seeds about 1.2-1.5 long, oblong, alveolate-reticulate, dark-brown or blackish.

Type, stony limestone knoll, Talpa, Coleman County, Texas, collected in flower and fruit May 20, 1920, F. W. Pennell 10516; in Herb. New York Botanical Garden.

Rocky calcareous bluffs and prairies or low hills, prairies of western Oklahoma, south to Coleman and Concho regions of central Texas; lower Sonoran Zone (at altitudes of 1,400 to 2,400 feet). Flowering in May and soon ripening fruit.

OKLAHOMA. [Beckham: Doxey, observed by Pennell]. Woods: Wynoka, Stevens (M, U); Whitehorse.

TEXAS. Callahan: Baird, E. J. Palmer 13695 (M). Coleman: Talpa, Pennell 10516 (A, H, K, M, O, T, U, Y). Howard: Big Spring, Eggert (M). Tom Green: San Angelo, Pennell 10501 (C, J, Y), 10508 (A, H, L, M, T, U, Y).

6. *Castilleja lanata* A. Gray.

Castilleja lanata A. Gray, in Torr., Bot. Mex. Bound. 118. 1859. "Along and near the Rio Grande, from Eagle Pass, etc., to El Paso; Wright (452, 1495), Bigelow, Parry, etc." Cotype, Wright 1495, seen in Herb. Columbia University at the New York Botanical Garden.

Bracts and sepals distally red. Flowering in late March and April.

leaves. Few fruits developed. Capsule 12-14 mm. long, probably not normal. No seeds seen. Inflorescence nearly whole height of plant. Sepals 20 mm. long, lateral narrowing, acutish. Corolla 25-30 mm. long, narrow, galea 8-10 mm. long, lip 3 mm. long, thin, distal portion as long as the thickened green basal portion.

From a different formation west of the range of *C. lindheimeri* A. Gray, but material insufficient for positive identification.

Arid valleys, near the Rio Grande in Valverde County, Texas. Extends westward through Trans-Pecos Texas; Lower Sonoran zone.

TEXAS. Valverde: Del Rio, Hanson 377 (Y), E. J. Palmer 11353 (M), Pilsbry (A).

7. *Castilleja latebracteata* Pennell, sp. nov.

Root perennial. Stems several or many, 2-4 dm. tall, finely pubescent or above bearing longer hairs, some hairs gland-tipped. Leaves 6-7 cm. long, oblong-ob lanceolate, 3-nerved, entire, roughish-puberulent or -pubescent. Bracts oblong or nearly obtriangular, broadly rounded, sometimes as wide as long, distally violet-red. Sepals 22-24 mm. long, those of each side united to apex, truncate-rounded, pubescent, distally violet-red. Corolla 25-27 mm. long; posterior lip 11-12 mm. long, pubescent dorsally, with broad thin margin; anterior about 1 mm. long, incurved. Stigma .5-.7 mm. wide. Capsule at least 11 mm. long.

Type, High Bridge of the Pecos, Valverde Co., Texas, collected in flower April 27-28, 1903, Dr. H. A. Pilsbry; in Herb. Academy of Natural Sciences of Philadelphia; isotype in Herb. New York Botanical Garden.

Nearly related to *C. nervata* Eastw., and *C. rigida* Eastw., both from Chihuahua. From both it differs in its wide leaves and lesser amount of pubescence; also from the former in larger flowers and lack of prominence of the lateral nerves or ribs of the leaf.

Flowering in late April.

Arid valleys, near the Rio Grande in Valverde County, Texas. Lower Sonoran Zone. Known only from original collection.

8. *Castilleja coccinea* (L.) Spreng.

Bartsia coccinea L., Sp. Pl. 602. 1753. "Habitat in Virginia, Noveboraco"

Type, Clayton 293, is certainly the plant here considered.

Castilleja coccinea (L.) Spreng., Syst. Veg. 2: 775. 1825.

Corolla yellowish-green, posterior lip yellowish-margined, the anterior yellowish-white with thickened green base. Bracts and sepals distally scarlet-red. Flowering from March to May.

Moist sandy meadows and glades, northwestern Arkansas; in Coastal Plain in moist pineland of Central Louisiana and on coast prairies of southwestern Louisiana. To be expected through intervening areas. Ranges from Maine to Manitoba and Kansas, south to Georgia and Louisiana.

ARKANSAS. Benton: —, Harvey 60 (M). Carroll: Beaver, E. J. Palmer 5590 (M).

LOUISIANA. Calcasieu: Lake Charles, Cocks (L); Welsh, E. J.

Palmer 7656 (M) [Leaves entire or nearly so, apparently approaching *C. indivisa* Engelm.]. Rapides: Alexandria, Hale (L).

9. *Castilleja indivisa* Engelm.

Castilleja indivisa Engelm., in Boston Journ. Nat. Hist. 5: 255. 1845. "284 . . . Prairies from Houston to the Colorado [Texas, Lindheimer]". Isotype, Lindheimer, Fasc. II., 284, collected in 1844, seen in Herb. Academy Natural Sciences of Philadelphia.

Corolla greenish, the posterior lip with yellowish thin margins and the anterior conspicuously thickened and green. Bracts and sepals distally red. Flowering from March to April and soon ripening fruit.

Sandy loam, prairies, through the Coastal Plain of middle Texas, from Hunt to Harris, Bexar and Kleburg counties. Common on the coast prairie of mid-coastal Texas, inland west of the pine belt to the black belt; Austroriparian Zone (at altitudes under 700 feet).

TEXAS. Austin: Kenney, Pennell 10312 (P, Y); San Felipe, Pennell 10291 (M, Y); Wallis, Pennell 10286 (A, C, H, J, K, L O, S, T, U, Y). Bexar: San Antonio, Blake (Y). Brazoria: Columbia, Bush 74 (M, U, Y). Brazos: Bryan, E. J. Palmer 7787 (M); College Station. Colorado: Eagle Lake, E. J. Palmer 4929 (M). Comal: New Braunfels, Lindheimer (M). Dallas: Dallas, Reverchon (A, M, P, U, Y). Dewitt: Cuero, Howell 297 (U). Fort Bend: Richmond, Bray 109 (T, U); Rosenberg. Harris: Houston, Hall 422 (M, U, Y), Pennell 10253 (Y); Hockley. Hunt: Commerce, Warren 124 (M). Jackson: Ganado, E. J. Palmer 9222 (M). Kaufman: Terrell, Reverchon (M). Kleburg: Kingsville, High 74 (M). McLennan: Waco, Ricker 3362 (U). Navarro: Corsicana, Reverchon 3222 (M). Robertson: Calvert, Merrill 27 (Y). Victoria: Victoria, Tracy 9165 (M, P, T, U, Y). Wharton: Hungerford, E. J. Palmer 4848 (M).

30. *PEDICULARIS* Linné.

Pedicularis L., Sp. Pl. 607. 1753.

Type species, *P. palustris* L., of Europe.

1. *Pedicularis canadensis* L.

Pedicularis canadensis L., Mant. 86. 1767. "Habitat in America septentrionali. Kalm." Description distinctive.

Corolla light-yellow throughout (not showing the purple frequently developed in northern plants of this species). (Cf. Nuttall, in Trans. Am. Phil. Soc. 5: 179. 1834.) Flowering in April, and soon ripening fruit.

Sandy soil, oak-knolls in long-leaf pineland, and on adjacent coast prairie, western Louisiana and eastern Texas. Ranges from Nova Scotia to Manitoba, south to Florida and Texas.

LOUISIANA. Calsasieu: DeQuincy, Pennell 10230 (A, C, H, U, Y); Perkins, Pennell 10212 (H, K, L, M, T, U, Y); Lake Charles, Cocks (L); Vinton. Natchitoches: Natchitoches, Cocks (L).

TEXAS. Jasper (?): 30 miles northeast of Beaumont, Bray 67 (T, U). San Augustine: San Augustine, Crocket (U).

HERBARIA IN WHICH SPECIMENS SEEN MAY BE CONSULTED.

Guide-letters in the list of specimens cited with each species refer to the following herbaria.

- A—Academy of Natural Sciences, Philadelphia, Pa.
- C—Field Museum of Natural History, Chicago, Ill.
- H—Gray Herbarium of Harvard University, Cambridge, Mass.
- I—University of Illinois, Urbana, Ill.
- J—Jardin des Plantes, Paris, France
- K—Kew Gardens, Kew, England
- L—Tulane University, New Orleans, La.
- M—Missouri Botanic Garden, St. Louis, Mo.
- N—University of Notre Dame, Notre Dame, Ind.
- O—Agricultural Experiment Station, Stillwater, Okla.
- P—University of Pennsylvania, Philadelphia, Pa.
- R—University of Wyoming, Laramie, Wyo.
- S—Charleston Museum, Charleston, S. C.
- T—University of Texas, Austin, Tex.
- U—United States National Herbarium, Washington, D. C.
- Y—New York Botanical Garden, Bronx Park, New York City

COLLECTORS WHOSE SPECIMENS ARE CITED IN LISTS ACCOMPANYING SPECIES.

Letters, following each name, denote state from which collector's specimens have been seen: A—Arkansas, L—Louisiana, O—Oklahoma, T—Texas.

Allison, Andrew (L).
 Ball, C. R. (L).
 Barker, C. (O).
 Berlandier, J. L. (T).
 Bigelow, J. M. (A, O, T).
 Biltmore Herbarium (A).
 Blake, W. P. (T).
 Blankinship, J. W. (O).
 Blankinship, L. A. (O).
 Bray, W. L. (T).
 Broadhead, G. C. (T).
 Buckley, S. B. (T).
 Bush, B. F. (A, L, O, T).

Butler, G. D. (O).
 Butler, Mrs. J. (T).
 Canby, W. M. (T).
 Carleton, M. A. (O).
 Chandler, H. P. (T).
 Clawson, A. B. (T).
 Clemens, J. (T).
 Cocks, R. S. (L).
 Coville, F. V. (A).
 Crawford, E. W. (T).
 Crocket, G. L. (T).
 Croft, M. B. (T).
 Dewey, L. H. (T).

- Diffenderfer, W. L. (T)¹¹
 Dixon, R. A. (T).
 Drummond, Thomas (L, T).
 Eggert, Henry (A, O, T).
 Emig, W. H. (O).
 Engelmann, George (A).
 Fisher, G. L. (T).
 Foreman, Edward (A).
 Gregg, Josiah (L).
 Griffith, (T).
 Groth, B. H. A. (T).
 Hale, Josiah (L).
 Hall, Elihu (T).
 Hanson, H. C. (T).
 Harvey, F. L. (A).
 Hasse, H. E. (A).
 Havard, Valery (T).
 Hayes, Sutton (T).
 Heller, A. A. & E. G. (T).
 High, M. M. (T).
 Hildebrandt, A. M. (T).
 Hill, R. J. (T).
 Hogan, George (T).
 Hollister, M. P. (A).
 Holstein, G. W. (T).
 Houghton, H. W. (O).
 Howell, A. H. (A, T).
 Hunt, E. A. (A).
 Jermy, Gustav (T).
 Jermy, Julius (T).
 Joor, J. F. (L, T).
 Langlois, A. B. (L).
 Larrabee, R. N. (T).
 Lea, A. V. (T).
 Learn, C. D. (O).
 Leavenworth, M. C. (A, T).
 Letterman, G. W. (A, T).
 Lewton, F. L. (T).
 Lincecum, Gideon (T).
 Lindheimer, Ferdinand (T).
 Lloyd, F. E. (L).
 Mackensen, Bernard (T).
 Mackenzie, K. K. (L).
 Marcy, R. B. (O).
 Marlott, C. L. (T).
 Maxon, W. R. (T).
 McAtee, W. L. (A).
 McReynolds, A. B. (O).
 Merrill, F. J. H. (T).
 Mexican Boundary Survey
 (Parry, Bigelow, Wright & Schott).
 Meyer, Emanuel (T).
 Milligan, Mrs. J. M. (T).
 Moseley, E. L. (L).
 Myers, S. E. (O).
 Nash, Mrs. M. L. (T).
 Nealley, G. C. (T).
 Neaves, Clara (O).
 Nuttall, Thomas (O).
 Olive, E. W. (O).
 Oyster, J. H. (O).
 Pace, Lula (T).
 Palmer, Edward (O, T).
 Palmer, E. J. (A, L, O, T).
 Pammel, L. H. (T).
 Parry, C. C. (T).
 Peck, C. (L).
 Pennell F. W. (A, L, O, T).
 Pilsbry, H. A. (A, O, T).
 Pitcher, Zina (A).
 Plank, E. N. (A, L, T).
 Pringle, C. G. (T).
 Reverchon, Julien (T).
 Ricker, P. L. (T).
 Robin, C. C. (L)¹²
 Römer, (T).¹¹
 Rose, J. N. (T).
 Ruth, Albert (T).
 Schott, Arthur (T).
 Schulz, E. D. (T).
 Seaman, W. H. (T).
 Sheldon, C. S. (O).
 Shepherd, T. M. (T).
 Smith, J. D. (L).
 Stanfield, S. W. (T).
 Stevens, G. W. (O).
 Tharp, B. C. (T).
 Thurber, George (T).
 Thuron, F. W. (T).
 Tracy, S. M. (L, T).
 Trelease, William (L).
 Tweedy, Frank (T).
 Tyler, F. J. (T).
 Vinzent, (T).
 Ward, L. F. (O, T).
 Warren, W. H. (T).
 Waugh, F. A. (O).
 Wells, B. W. (A).
 White, M. J. (T).
 White, P. J. (O).
 Williamson, C. S. (A, T).
 Wolf, (T).
 Woodhouse, S. W. (O).
 Wright, Charles (T).
 Wurzlow, E. C. (L).
 Wurzlow, H. (T).
 York, H. H. (T).
 Young, M. S. (T).

¹¹ Collector of the type of a species from this area, but specimens not seen.

¹² Traveled in Louisiana and described many plants seen, but not known to have collected specimens.

ABSTRACTS OF THE MINUTES OF THE PROCEEDINGS
OF THE ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA

1921

JANUARY 18.

The President, JOHN CADWALADER, A.M., LL. D., in the Chair.
Eighty-two persons present.

The deaths of Edward J. Nolan, Librarian and Recording Secretary Emeritus, and Joseph G. Rosengarten, were announced.

Dr. William E. Hughes made a communication entitled: "Across the Peruvian Andes to the Amazon." (No abstract.)

The Council reported the appointment by the President of the following Committees: On Finance—Effingham B. Morris, *Chairman*, George L. Harrison, Jr., Morgan Hebard, Walter Horstmann, and the Treasurer, George Vaux, Jr. On Publications—Henry Skinner, *Chairman*, Milton J. Greenman, Witmer Stone, Henry A. Pilsbry, William J. Fox. On Library—Henry Tucker, *Chairman*, F. J. Keeley, T. Chalkley Palmer, Witmer Stone, Spencer Trotter. On Instruction—Henry Skinner, *Chairman*, Charles Morris, Henry A. Pilsbry, James A. G. Rehn.

William Randolph Taylor, C. Montague Cooke, Stephen Fuguet, Samuel Copeland Palmer, and Lambert Cadwalader, were elected members.

FEBRUARY 15.

The President, JOHN CADWALADER, A. M., LL. D., in the Chair.
One hundred and forty-four persons present.

The deaths of George W. Carpenter, and James Gibbons Huneker, were announced.

MR. ARTHUR H. FISHER made a communication entitled: "An Animated Photographic Journey through the Philadelphia Zoological Gardens." (No abstract.)

John Wagner, and Henry Frazer Harris, were elected members.

The Publication Committee reported the receipt of the following papers for publication:

"Two Week's Collecting in Yellowstone National Park," by Annette M. Braun.

"Some Faunal Remains from the Trias of York County, Pennsylvania," by H. E. Wanner.

"New or Little-known Crane-flies from the Amazonian Region," by Charles P. Alexander.

MARCH 15.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.
Sixty-four persons present.

The deaths of John H. McFadden, Daniel Baugh, and Stewardson Brown, were announced.

MR. JAMES A. G. REHN made a communication entitled: "The Academy Colombian Expedition of 1920." (No abstract.)

Samuel S. Fels was elected a member.

APRIL 19.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.
Thirty persons present.

The death of James D. Winsor was announced.

DR. HENRY SKINNER made a communication entitled: "A Collecting Trip to the Sierra La Sal, Utah." (No abstract.)

Frederick Wistar Morris, Jr., was elected a member.

The Publication Committee reported the receipt of the following papers for the Proceedings:

"Scrophulariaceae of the West Gulf States," by Francis W. Pennell.

"Desilicated Granitic Pegmatites," by Samuel G. Gordon.

"South American Blattidae from the Muséum National d'Histoire Naturelle, Paris, France," by Morgan Hebard.

"Revision of W. M. Gabb's Tertiary Mollusca of Santo Domingo," by Henry A. Filsby.

NOVEMBER 15.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.
Thirty-nine persons present.

The deaths of Hiram Milliken Hiller and Miss Emma Walter were announced.

Mr. J. Fletcher Street made a communication entitled: "A Study of the Wild Bird Life of the New Jersey Coast," (No abstract.)

Nominations for Officers, Councillors, and members of the Committee on Accounts for the ensuing year were made.

The following were elected members: T. Ellis Barnes, R. Dale Benson, Jr., Mrs. Andrew Alexander Blair, Joseph Hall Bodine, Mrs. Edward Bok, Dr. John B. Carson, John D. Carter, Wilson Catherwood, Charles D. Clark, Alexander Brown Coxe, Mrs. James H. R. Cromwell, George K. Crozer, Jr., Edwin S. Dixon Jr., Archibald M. L. duPont, E. Paul duPont, Thomas Langdon Elwyn, William Newbold Ely, Mrs. Stanley G. Flagg, Jr., C. F. Fox, Mrs. Eva. B. Gadsby, Thomas S. Gates, John Gilbert, George L. Harrison, Mrs. Charles W. Henry, John C. Holinger, Wharton Huber, Charles F. Jenkins, Dr. Victor A. Loeb, C. Christopher Morris, Dr. Francis W. Pennell, Thomas Robins, John W. Schell, Miss Hepsey Norris Wells, Dr. D. H. Wenrich, Dr. Arthur Dewitt Whedon, Walter Wheeler.

The Publication Committee reported the receipt of the following papers for the Proceedings:

"The Chromite Deposits of the State Line Serpentine," by Samuel G. Gordon.

"Notes on Hemibranchiate and Lophobranchiate Fishes," by Henry W. Fowler.

"Notes on the Radula of the Helicinidae," by H. Burrington Baker.

"Plant Indicators of Soil Types," by Arthur Pierson Kelley.

"Notes on the Mollusks of the Colorado Desert, I," by S. Stillman Berry.

"Some Sharks' Teeth from the California Pliocene," by David Starr Jordon.

DECEMBER 20.

The President, JOHN CADWALADER, A.M., LL.D., in the Chair.
Twenty-six persons present.

Officers, Councillors, and members of the Committee on Accounts were elected for the ensuing year as follows:

PRESIDENT.....John Cadwalader, A.M., LL.D.

VICE-PRESIDENTS.....Edwin G. Conklin, Ph.D.

Henry Skinner, M.D., Sc.D.

RECORDING SECRETARY.....James A. G. Rehn.

CORRESPONDING SECRETARY.....J. Percy Moore, Ph.D.

TREASURER.....George Vaux, Jr.

LIBRARIAN.....Spencer Trotter, M.D.

Curators.....	Witmer Stone, A.M., Sc.D. Henry A. Pilsbry, Sc. D. Henry Tucker, M.D. George Spencer Morris.
COUNCILLORS TO SERVE THREE...	Philip P. Calvert., Ph. D.
YEARS.....	F. J. Keeley. Walter Horstmann. T. Chalkley Palmer.
COUNCILLOR TO FILL UNEXPIRED TERM OF GEORGE SPENCER MOR- RIS (resigned)	Morgan Hebard.
COMMITTEE ON ACCOUNTS.....	Charles Morris. John G. Rothermel. Samuel N. Rhoads. Charles S. Stewart, M.D. Walter Horstmann.

Annual Reports were received from the Secretary, Corresponding Secretary, Librarian, Curators, Treasurer, auditors of the Treasurer's accounts, Treasurer of the "Manual of Conchology," Curator of the William S. Vaux Collections, and from the following sections: Biological and Microscopical, Entomological, Botanical, Ornithological, Mineralogical and Geological.

The following were elected members: Miss Alice O. Albertson, Dr. Joseph L. T. Appleton, Jr., Dr. Clement Biddle, Malcolm H. Bissell, Mrs. Samuel Chew, Clarence M. Clark, Mrs. William Dreen, Mrs. G. W. C. Drexel, Henry S. Drinker, Jr., Louis H. Eisenlohr, Van Horn Ely, Arthur F. Hagar, Henry Reed Hatfield, Mrs. Frederick Hemsley, Mrs. Charles Willing Huber, John F. Huneker, Dr. Robert H. Hutchison, Dr. Peter M. Keating, Dr. Edward C. Kirk, Gustavus W. Knowles, Arthur H. Lea, Charles M. Lea, Miss Nina Lea, Howard W. Lewis, M. Albert Linton, Miss Caroline Lippincott, Mrs. J. Bertram Lippincott, Horatio Gates Lloyd, Mrs. Horatio Gates Lloyd, Malcolm Lloyd, Jr., Dr. Edward Lodholz, Charles H. Ludington, Percy C. Madeira, Jr., Mrs. Arthur V. Meigs, William R. Mercer, Miss Susan S. Miles, J. Clark Moore, Jr., Arthur E. Newbold, Jr., William Peterson Newhall, Dr. Ralph Pemberton, George L. Pennock, John M. Phillips, Dr. George Morris Piersol, W. S. Pilling, Mrs. Horace Miles Potts, G. Colesberry Purves, Mrs. Evan Randolph, Samuel Rea, Miss Marion Reilly, Dr. David Riesman, Mrs. Ernestine

M. Schell, Mrs. E. O. Shakespeare, S. F. Sharpless, Miss Caroline Sinkler, Alfred G. B. Steel, Hon. Mayer Sulzberger, Nicolas Thouron, Dr. B. M. Underhill, Daniel B. Wentz, Mrs. William D. Winsor, Clement B. Wood, Mrs. George Woodward. *Associate Members*: Earl L. Polle (Reading, Pa.). *Junior Members*: Franklin Pb Cook, John T. Emlen, Jr., William P. Harrington, Charles Eliot Underdown.

INDEX TO GENERA AND SPECIES DESCRIBED AND REFERRED TO IN THE PROCEEDINGS FOR 1921

New species and genera are indicated by heavy-faced type.

Acanthopterocletes	22	Albite	169, 170, 173	180
tripunctata	23	Allanite	184, 185,	192
Aclis (Hebetacelis) alta	389	Almandite		192
(Amblyspira) bartschiana	389	Amauropsis altispira		387
Acrocercops astericola	18	burnsii meridionalis		387
Acteocina canaliculata	310	guppyi		386
candei	310	Amphibole		186
recta	310	Amusium papyraceum		413
subbullata	310	Anacampsis niveopulvella		8
wetherilli	310	paltodoriella		8
Acteon punctostriatus	310	Anachis exilis		350
subtornatilis	310	gracilicostata		350
Actinolite	179, 186, 187,	(?) quadrata		350
192		Anaplecta bivittata		222
Afzelia cassioides	508	maronensis		194
havardii	507	pulchella		195
pectinata	507	xanthopeltis		222
texana	507	Andesine	170, 171,	189
Agalaxis aspera	516	Anomia gabbi		409
caddoensis	519	sp.		409
edwardsiana	522	Anorthite		192
edwardsiana glabra	523	Anthophyllite	185,	191
fascicula	518	Antigorite		171
gattingeri	521	Apatite	185,	192
heterophylla	515	Apeltes quadracus		438
homalanthia	525	Aplite		171
oligophylla	520	Aragonite	186,	192
pinetorum	517	Arca bonaczyi		403
pulchella	519	chiriquiensis		405
purpurea	517	chiriquiensis websteri		406
spiciflora	516	(Scapharca) coccopleura		406
strictifolia	520	(Scapharca) copiosa		403
tenuifolia	523	cyclica		407
t. leucanthera	524	(Scapharca) devexa		404
t. macrophylla	524	dolaticosta		406
t. parviflora	525	grandis		404
viridis	521	idiodon		408
Agonopteryx nivalis	10	inaequilateralis		403
rosaciliella	10	(Scapharca) intumescens		404
Alaba maoensis	376	maoica		407
Alabina angustior	376	multilineata		407
canaliculata	375	(Scapharca) pennelli		403
Alachista agilis	16	perfaceta		407
Albite	177, 184, 183,	pomponiana		407
192				

(Scapharca) proletaria	404	solida	313
(Scapharca) sobrina	403	Bursa amphitrites	360
(Argina) tolepis	406	bifoniopsis	360
f. crassicaudinis	407	crassa proavus	360
f. saxea	406	Cadulus colobus	401
f. scapularis	407	depressicollis	401
umbonata	403	elegantissimus	401
Architectonica quadriseriata	379	phenax	400
Argyresthia oreasella	14	Caecum anellifer	378
Aristotelia rubidella	6	(Meioceras) constrictum	378
Astasia mobilis	152	Calcite	186
Astraea domingensis	396	Calliostoma leve	396
Atarba megaphallus	59	Calyptrea centralis	385
Atlanta cordiformis	315	Cancellaria barretti	332
peronii	315	epistomifera	333
rotundata	314	gabbiana	334
Atrina sp.	408	ellipsis	333
Aty's (Aliculastrum) caribaea	313	guppyi	333
cinctorii	311	(Trigonostoma) insularis	334
sulculatorum	311	larvescens	333
Aulostomus chinensis	439	rowelli	333
maculatus	439	Candona rogersi	28
Aureolaria calycosa	512	Capulus inornatus	384
dispersa	511	Cardium (Trachycardium) domin-	
flava macrantha	511	icanum	420
grandiflora	510	(Trachycardium) domicense	421
g. cinerea	510	(Trigoniocardia) haitense	421
g. serrata	511	(Laevicardium) serratum	421
pectinata	509	tintinnabularum	421
virginica	510	(Laevicardium) venustum	421
Aurinia striata	339	Caribblatta mesembrina	258
Beryl	192	Cassia inflata monilifera	361
Bicoeca exilis	117	sulcifera	360
Biotite 170 - 172, 177 - 182, 185,		(Cypraecassis) testiculus	361
191, 192		Castilleja citrina	532
Bittium asperoides	375	coccinea	533
yaquense	375	indivisa	534
Blaberus fraternus	290	labiata	530
giganteus	213	lanata	532
Blaptica dubia	290	latebracteata	533
interior	286	lindeheimeri	531
Blatta orientalis	285	purpurea	531
Blatella germanica	264	sessiliflora	530
Borkhausenia haydenella	12	Centriscoops humerosus	440
Borsonia recurvirostris	326	Centriscoops scutatus	441
(Paraborsonia) varicosa	325	strigatus	441
Brachycola tuberculata	252	Ceratocheilus americanum	91
Brachypremna basilica	92	Cerithium dominicense	370
breviventris	92	(obesum?) gurabense	372
candida	91	microlineatum	369
dispellens	92	obesum	371
uniformis	92	obesum harrisi	372
williamsoni	92	obesum ventricosior	371
Bramia minnieri	474	simplex	372
Brookite	186, 192	turriculum	370
Buchnera americana	527	uniseriale	370
elongata obtusa	528	(?) venustum	373
Bullaria paupercula	313	Ceuthobia	292
		fulvella	295

lepta	293	mus	331
Ceuthobiella	246	planiliratus	329
Chabazite	188, 192	proteus	331
Chalcocpla	20	proteus humerosus	332
cockerelli	21	pseudomarginatus	330
itoniella	21	recognitus	327
ovata	21	simplicissimus	332
Chalcopyrite	186	strombiformis	330
Chama chipolana	416	stenostoms	327
involuta	416	symmetricus	328
tampaensis	416	trisculptus	330
Chione guppyana	423	xenicus	328
(Liophora) paphia	423	yaquensis	331
soca	423	Coralliophila abbreviata	354
santodomingensis	423	Corbula dominicensis	427
Chlorite	185, 187, 191	knoxiana fossilis	427
Choreutis balsamorrhizella	14	sericea	427
caliginosa	13	vieta	427
occidentella	14	(Bothrocorbula) viminea	428
pernalis	12	Corundophilite	186, 192
Chorisonera barticae	219	Corundum 170-172, 182-188, 191, 192	
gracilis	252	Corythoichthys albirostris	442
guianae	217	conspicillatus	442
lata	217	fasciatus	442
nigrifrons	252	Crassitellites (Crassinella) dolatus	415
perlucida	251	(Crassinella) guppyi radiata	415
Chromite	172, 186, 449-454	(Crassinella) microdelta	415
Chrysamoeba radians	132	reevei	415
Chrysopyxis bipes	138	Crenella diuturna	414
Circulus domingensis	397	rota	414
pentagona	397	Crepidula plana	385
Clathurella amica	323	Crepitacella cepula	380
gracilis	323	Crucibulum auricula	385
paupereula	323	auricula spinosum	385
Clava plebeia	373	striatum	385
Clavatulab labiata	324	Cryptolabis (Cryptolabis) tenui-	
Coleophora albicostella	14	ncicta	73
brunneipennis	15	Cryptomonas ovata	114
crinita	15	Ctenolimnophila	61
tenuis	14	bivena	61
Colerainite	192	decisa	62
Collinsia violacea	499	Cuspidria gabbi	415
Columbella inflata	350	ornator	414
Conus aratus	329	Cyclinella cyclica domingensis	424
bonaczyi	331	ovumlaerta	311
catenatus	328	Cymatium domingense	356
ceradensis	332	pileare	356
consobrinus	330	praeferomale	356
consobrinus ultimus	330	Cymia henekeni	355
domingensis	327	henekeni tectiformis	355
furvoides	328	Cyphophora triceristatella	5
furvoides brachys	328	Cypraea campbelliana	365
gabbi	332	cinerea	361
gaza	330	dominicensis	361
haytensis	326	henekeni	365
haytensis politispira	327	isabella	361
imitator	327	raymondrobertsi	365
larvatus	332	spurea	365
longitudinalis	330	spureoides	365
maculospira	330		

<i>Cythara elevata</i>	323	<i>fusiformis</i>	318
<i>elongata</i>	323	<i>gatonensis alia</i>	319
<i>heptagona</i>	322	<i>henekeni</i>	318
<i>polygona</i>	322	<i>hexapleura</i>	321
<i>Cytherea (Ventricola) blandiana</i> ..	424	<i>ischnatracta</i>	321
(<i>Antigona</i>) <i>tarquina</i>	423	<i>jamaicensis</i>	320
<i>Damourite</i>	183, 192	<i>lissotropis dorsuosa</i>	321
<i>Dasistoma macrophylla</i>	505	<i>macilenta rectaxis</i>	319
<i>Dasyblatta</i>	224	<i>mimula</i>	321
<i>chopardi</i>	257	<i>orthopleura</i>	321
<i>thaumasia</i>	225	<i>parkeri</i>	321
<i>Dentalium callioglyptum</i>	399	<i>scala</i>	321
<i>cossmannianum</i>	399	<i>sororcula</i>	318
<i>dissimile</i>	400	<i>squamosa</i>	320
<i>d. ponderosum</i>	400	<i>subgibbosa</i>	318
<i>eboreum</i>	400	<i>venusta</i>	320
<i>gabbi</i>	400	<i>winchesteræ</i>	318
<i>haytense</i>	400	<i>Dunite</i>	170, 187, 191
<i>præcursor</i>	400	<i>Echinochama yaquensis trachy-</i>	
<i>pyrum</i>	400	<i>derma</i>	416
<i>sagittarii</i>	400	<i>Elachista aurocristata</i>	16
<i>tryoni</i>	399	<i>stramineola</i>	16
<i>Diacria bisulcata</i>	309	<i>Elephantomyia supernumeraria</i>	60
<i>Diadora alternata henekeni</i>	399	<i>Enicostoma quinquecristata</i>	11
<i>Diaspore</i>	183, 186, 188, 192	<i>Enstatite</i>	191
<i>Dicranomyia acuminata</i>	51	<i>Entelurus aequoreus</i>	441
<i>amazonica</i>	49	<i>Epicallima dimidiella</i>	12
<i>capnora</i>	47	<i>quadrinaculata</i>	12
<i>egæ</i>	49	<i>Epidote</i>	192
<i>eiseni</i>	49	<i>Epilampra abdomen-nigrum</i>	206
<i>fumosa</i>	52	<i>azteca</i>	206
<i>napoensis</i>	50	<i>berlandi</i>	283
<i>optabilis</i>	48	<i>conspersa</i>	206
<i>rapax</i>	50	<i>grisea</i>	206
<i>Dimorpha monomastix</i>	116	<i>heusseriana</i>	281
<i>tetramastix</i>	110	<i>maculicollis</i>	206
<i>Dimya grandis</i>	413	<i>verticalis</i>	240
<i>Diotrepha atriabasis</i>	57	<i>Epiphragma fabricii</i>	63
<i>fumicosta</i>	58	<i>varia</i>	63
<i>Diplodon borealis</i>	33	<i>Epitonium amosbrowni</i>	388
<i>carolus-simpsoni</i>	34	<i>amplum</i>	388
<i>pennsylvanicus</i>	32	<i>minutissimum</i>	388
<i>wanneri</i>	34	<i>santodominganum</i>	388
<i>yorkensis</i>	35	<i>Eriocera amazonicola</i>	68
<i>Diplodonta (Sphaerella) capu-</i>		<i>macrocera</i>	68
<i>loides</i>	419	<i>Erioptera (Erioptera) annulipes</i> ..	69
<i>dedecotis</i>	418	(<i>Erioptera</i>) <i>apicalba</i>	70
(<i>Phlyctiderma</i>) <i>gabbi</i>	418	(<i>Mesocyphona</i>) <i>bicinctipes</i>	71
<i>Distorsio constrictus similimus</i>	356	(<i>Erioptera</i>) <i>cladophora</i>	69
<i>Divaricella proletaria</i>	418	(<i>Mesocyphona</i>) <i>diffusa</i>	71
<i>Donax aequalis</i>	426	(<i>Mesocyphona</i>) <i>invariegata</i> ..	71
<i>Doryrhamphinarum brachyurum</i> ..	442	(<i>Erioptera</i>) <i>micromyia</i>	69
<i>lineatum</i>	441	(<i>Mesocyphona</i>) <i>parva brasil-</i>	
<i>Dosinia azuana</i>	424	<i>iensis</i>	70
<i>Drillia callistopleura</i>	321	<i>Estheria ovata</i>	28
<i>callistura</i>	321	<i>Ethmia albistigella</i>	12
<i>consors</i>	319	<i>Eubiaberus argentinus</i>	290
<i>elocata</i>	318	<i>biolleyi</i>	213
<i>esculenta</i>	321	<i>Eucalia inconstans</i>	438
<i>foveolata</i>	321	<i>Eudromiella aglaia</i>	255

<i>Euglena pseudomermis</i>	158	<i>alnivorella</i>	18
<i>Euphyllite</i>	183, 192	<i>Granulite</i>	170, 172
<i>Euphyllodromia chopardi</i>	202	<i>Gratiola flava</i>	472
<i>literata</i>	201	<i>gracilis</i>	472
<i>Euthyrrapha pacifica</i>	251	<i>neglecta</i>	472
<i>Fasciolaria kempfi</i>	346	<i>pilosa</i>	470
<i>semistriata</i>	346	<i>ramosa drummondi</i>	471
<i>Feldspar</i>	186, 189	<i>virginiana</i>	473
<i>Fistularia petimba</i>	439	<i>Greya subalba</i>	21
<i>tabacaria</i>	438	<i>Haminea granosa</i>	313
<i>Fusinus haitensis</i>	347	<i>Harpa americana</i>	337
<i>henekeni</i>	347	<i>Hedaia yersiniana</i>	240
<i>Gasterosteus aculeatus</i>	437	<i>Hematite</i>	186
<i>a. cataphractus</i>	438	<i>Hemisinus truncatus</i>	379
<i>Gastrotokes biaculeatus</i>	441	<i>Hippocampus abdominalis</i>	446
<i>Gelechia abradescens</i>	9	<i>ecuadorensis</i>	446
<i>alternatella</i>	10	<i>hippocampus</i>	445
<i>conspersa</i>	9	<i>hudsonius</i>	445
<i>lugubrella</i>	8	<i>ingens</i>	446
<i>metallica</i>	9	<i>insdonis</i>	446
<i>unifasciella</i>	9	<i>kuda</i>	446
<i>versutella</i>	9	<i>punctulatus</i>	446
<i>Geranomyia bicincta</i>	44	<i>zosteræ</i>	446
<i>bicincta angusticincta</i>	45	<i>Hipponyx otiosa</i>	384
<i>cinereinota</i>	46	<i>pilosa</i>	384
<i>pilipes</i>	45	<i>Histiona campanula</i>	120
<i>recondita</i>	42	<i>Holocompsa nitidula</i>	217, 251
<i>separata</i>	45	<i>Hormetica</i>	253
<i>xanthoplaca</i>	43	<i>ventralis</i>	253
<i>Gladkaite</i>	170	<i>Hornblende</i>	177, 186, 192
<i>Globifera umbrosa</i>	478	<i>Hyalobryon ramosum</i>	140
<i>Glycymeris acuticostatus</i>	408	<i>Hydrantheum egense</i>	475
<i>approximans</i>	408	<i>Hydrotida caroliniana</i>	474
<i>diffidentiae</i>	408	<i>Hypercompsa cynipoides</i>	251
<i>santodomingensis</i>	408	<i>Hyporhynchoda maronensis</i>	207
<i>Glyphostoma dentiferum</i>	324	<i>Ilmenite</i>	186, 192
<i>Gnophomyia axillaris</i>	75	<i>Ischnoptera argentina</i>	270
<i>bisecta</i>	76	<i>bilunata</i>	272
<i>leucoplaca</i>	76	<i>carcarana</i>	267
<i>nigrina</i>	75	<i>icano</i>	276
<i>osten-sackeni</i>	76	<i>ignobilis</i>	265
<i>rubicundula</i>	74	<i>litostylata</i>	272
<i>subhyalina</i>	75	<i>saussurei</i>	274
<i>Gnorimoschema contraria</i>	8	<i>Ilysanthes dubia</i>	476
<i>erigeronella</i>	7	<i>inaequalis</i>	477
<i>ochreostrigella</i>	9	<i>Jefferisite</i>	180, 183, 192
<i>triocellella</i>	7	<i>Kaolinite</i>	192
<i>Gonomyia (Leiponeura) acumin-</i> <i>ata</i>	77	<i>Labiosa (Raeta) gabbi</i>	427
<i>(Leiponeura) amazona</i>	77	<i>Labradorite</i>	189, 192
<i>(Leiponeura) bispinosa</i>	82	<i>Lampronia obscurumaculata</i>	20
<i>(Leiponeura) crepuscula</i>	82	<i>piperella</i>	20
<i>(Leiponeura) ctenophora</i>	81	<i>politella</i>	19
<i>(Leiponeura) falcifer</i>	79	<i>quieta</i>	19
<i>(Leiponeura) machaeria</i>	79	<i>vatiata</i>	20
<i>(Progonomyia) paraensis</i>	77	<i>Lanta</i>	295
<i>(Leiponeura) phoroctenia</i>	80	<i>peniculiger</i>	298
<i>(Leiponeura) pleuralis</i>	77	<i>scotia</i>	296
<i>(Leiponeura) spicata</i>	83	<i>Latindia dohrniana</i>	216
<i>Gracilaria acerifoliella</i>	18	<i>Latirofusus exilis</i>	346

<i>Latirus angustatus</i>	346	<i>Melanella gabbiana</i>	394
<i>brevicaudatus santodomingensis</i>	345	<i>Melestora</i>	250
<i>elongatus</i>	345	<i>argentina</i>	299
<i>fusiformis</i>	345	<i>Melongena</i> (?) <i>antillarum</i>	347
<i>infundibulum</i>	345	<i>consors</i>	347
<i>Lecteria armillaris</i>	91	<i>orthacantha</i>	348
<i>Leda extricata</i>	402	<i>Metis chipolana</i>	425
<i>Leptonotus tristriatus</i>	444	<i>efferta</i>	425
<i>Leucophaea maderae</i>	241	<i>postrema</i>	426
<i>Leucophyllum texanum</i>	481	<i>Metula cancellata</i>	349
<i>Leucospora multifida</i>	478	<i>Metulella dominicensis</i>	352
<i>Leucozonia rhomboidea</i>	345	<i>fusiformis</i>	352
<i>Leuropeltis</i>	198	<i>venusta</i>	352
<i>atopa</i>	200	<i>Micrognathus jonesi</i>	442
<i>Limacina inflata</i>	308	<i>Microtipula amazonica</i>	97
<i>Limnophila diversipes</i>	62	<i>Mimulus alatus</i>	480
(<i>Limnophilella</i>) <i>epihragmoides</i>	62	<i>glabratus</i>	479
<i>Limonite</i>	192	<i>ringens</i>	480
<i>Limopsis ovalis</i>	402	<i>Minerva saurodosus</i>	455
<i>Linaria canadensis</i>	501	<i>Mitra barbadensis</i>	341
<i>canadensis texana</i>	502	<i>granulosa</i>	340
<i>linaria</i>	503	<i>henekeni</i>	339
<i>Liosilpha</i>	235	<i>longa</i>	339
<i>pumicata</i>	237	<i>mesolia</i>	341
<i>Lithocolletis oregonensis</i>	18	<i>rudis</i>	340
<i>Lithophaga antillarum</i>	414	<i>Modiolaria</i> sp.	414
<i>Litoblatta</i>	237	<i>Modiolus</i> sp.	414
<i>brasiliensis</i>	238, 264	<i>Modulus</i> sp.	376
<i>Lucina bulla</i>	417	<i>Molophilus</i> (<i>Eumolophilus</i>) <i>pen-</i>	
<i>janus</i>	417	<i>nipes</i>	72
<i>mauryae</i>	417	(<i>Eumolophilus</i>) <i>thaumasto-</i>	
<i>Lyria pulchella</i>	338	<i>podus</i>	72
<i>soror</i>	338	<i>Molybdenite</i>	177, 192
<i>Marcocallista</i> (<i>Chionella</i>) <i>macu-</i>		<i>Mompha unifasciella</i>	6
<i>lata</i>	422	<i>Monastria biguttata</i>	246
(<i>Chionella</i>) <i>planivieta</i>	422	<i>Morum domingense</i>	363
<i>Macrorhamphosus scolopax</i>	440	<i>Murex</i> (<i>Chicoreus</i>) <i>brevifrons</i>	352
<i>scolopax elevatus</i>	440	<i>domingensis</i>	353
<i>Mactra dariensis</i>	427	<i>recurvirostris</i>	353
<i>Macuillamia rotundifolia</i>	475	<i>rufus compactus</i>	352
<i>Magnetite</i>	172, 179, 185	(<i>Pteropurpura</i>) <i>textilis</i>	353
<i>Malanella astuta</i>	349	<i>yaquensis</i>	353
<i>Malea camura</i>	363	<i>Muricea striata</i>	354
<i>elliptica</i>	363	<i>Muscovite</i>	179, 182, 192
<i>goliath</i>	363	<i>Mycetopoda diluculi</i>	36
<i>Manglia dominicensis</i>	322	<i>Nassaria corrugata</i>	348
<i>Margarite</i>	182, 183, 186, 188, 192	<i>Natica canrena</i>	386
<i>Marginella amina</i>	338	<i>sulcata</i>	386
<i>coniformis</i>	337	<i>youngi</i>	386
<i>cercadensis</i>	338	<i>Neaeromya quadrata</i>	419
<i>domingoensis</i>	338	<i>Neoblatella adpersicollis</i>	198, 232
<i>latissima</i>	338	<i>berlandi</i>	234
<i>nugax</i>	337	<i>conspersa</i>	260
<i>sowerbyi</i>	337	<i>eudromielloides</i>	232
<i>Martesia sanctipauli</i>	428	<i>janeirae</i>	226
<i>Maurandya antirrhiniflora</i>	500	<i>platystylata</i>	198, 229
<i>Mecardonia acuminata</i>	468	<i>puerilis</i>	262
<i>peduncularis</i>	469	<i>tapenagae</i>	262
<i>Megistocera longipennis</i>	94	<i>Nerophis maculatus</i>	441
		<i>Niso grandis</i>	394

minuta	394	(Amusium?) correctus	413
Nucula tenuisculpta	401	eccentricus	412
(Acila) tuberculata	401	inaequalis	412
Nyctibora holosericea	205	interlineatus	411
sericea	239, 281	ischnon	413
Odostomia (Odostomidea) bart-		oxygonum	411
schiana	393	plurinominis	411
(Eulimastoma) bathyrappe ..	393	scissuratus	411
(Goniodostoma) circumvineta ..	393	soror	410
(Parthenina?) cyclocephala ..	393	thetidis	410
(Chrysallida) dulcis	394	uselmae	412
(Odostomia) ingloria	392	Pedicularis canadensis	534
(Odostomidea) mogindo	393	Pegmatites	169-192
myrmecoon	392	Penstemon albidus	487
(Eulimastoma) pyrgulopsis	392	ambiguus	497
santodomingensis	392	angustifolius	486
(Goniodostoma) superans	393	arkansanus	493
(Evalea?) vexator	393	a. pubescens	494
Oligoclase	173, 179, 184-189, 192	baccharifolius	498
Oliva brevispira	335	buckleyi	486
cylindrica	335	cobaea	489
dimidiata	336	c. purpureus	490
gradata	335	digitalis	491
proavia	335	fendleri	487
reticularis	334	grandiflorus	486
Olivella floralia	336	guadalupensis	488
mutica	336	multicaulis	494
muticoides	336	murrayanus	485
nivea	337	pauciflorus	495
rosalina	337	penstemon	492
Orimarga pallidibasis	56	tenuis	492
Orthaulax inornatus	368	triflorus	488
inornatus atilis	369	tubiflorus	491
Orthoclase	172	Penthoptera batesi	67
Ostrea bolus	409	Peridotite	170, 182, 187, 191
cahobasensis	409	Periplaneta americana	241
frons	409	brunnea	208, 285
haitensis	409	Petasodes mouffeti	245
vaughani insularis	409	Phacoides (Lucinisca) muricatus ..	417
Otophylla auriculata	526	perplexus	416
densiflora	527	(Parvilucina) pupulus	417
Oulopteryx	214	riocanensis	416
dascilloides	215	(Parvilucina) yaquensis	417
meliponarum	247	Phasianella affinis	396
Ozodocera (Ozodocera) attenuata ..	96	Phoraspis brachytaenia	239
(Ozodocera) bispinifer	96	flavipes	239
(Ozodocera) extensa	95	picta	240
(Ozodocera) noctivagans	95	Phortioeca nimbata	212
(Dihexaclonus) triguttata	94	Phos (Strogilocera) costatus	349
Panchlora cubensis	208, 241	elegans	349
prasina	241	gabbi	349
thalassina	285	guppyi	349
Pandora inconspicua	414	semicostatus	348
Parahormetica bilobata	254	Phyllopteryx foliatus	445
tumulosa	254, 299	Pitar (Lamelliconcha) acuticosta-	
Parapegasus natans	441	tus	422
Paratropesa collaris	84	(Hyphantosoma) carbaseus	422
Partropes elegans	206	tryonianus	422
Pecten augusticostatus	412		

Plagiaplite	170	Rhodolite	188, 192
Plagioclase	172, 188, 191	Rictaxis oryza	310
Plicatula gibbosa	413	Ringicula semilimata	313
Plochelaea crassilabrum	341	Rissoa epulata	384
gabbi	342	(Alvania) proavita	384
Plumasite	170, 182-189	Rissoina bryerea	384
Plutella vanella	14	(Zebina) laevigata	382
Polinices mamillaris	386	minuta	383
Polymera conjuncta	66	Rocellaria sp.	428
conjunctoides	66	Rutile	184, 185, 186, 192
crystalloptera	67	Salpingoeca lepidula	127
hirticornis	66	polygonatum	123
niveitarsis	67	Saxonite	184, 185, 187
obscura	66	Schizopilia fissicollis	208
parishi	66	Schwalbea australis	528
pleuralis	66	Sciablatta poecila	196
superba	67	Scobinella magnifica	325
thoracica	66	tristis	325
Potamides caobassensis	374	Sconsia laevigata	361
dentilabris	374	Scrophularia marilandica	499
gastrodon	374	occidentalis	498
haitensis	373	Scythris eboracensis	19
prismaticus	373	impositella	19
suprasulcatus	373	magnatella	19
Psacaphora deceptella	5	Semele delimata	425
sexstrigella	5	firma	425
Psaronius brevitiba	65	Serpulorbis papulosus	376
mancus	64	Sigmatomera amazonica	91
obscurus	63	Siliqua subaequalis	426
pallipes	63	Sillimanite	192
trianguliferus	63	Simaethis fabriciana alpinella	12
pygmaeus	63	Smaragdia viridis	396
Pseudischnoptera lineata	204	Smaragdite	186, 188
rhabdota	278	Solariella (?) tricarinata	397
Pseudomops neglecta	278	Solenognathus guntheri	445
Pteria inornata	408	Sophronanthe hispida	473
Pteridomonas scherffeli	105	Sphecophila polybium	216
Pungitius pungitius	437	Spinachia spinachia	437
Pustularia gabbiana	366	Spinel	192
Pycnoscelus surinamensis	241	Spirorbis inexpectatus	36
Pyramidella canaliculata	390	Spondylus bostrychites	413
forulata famelica	391	gumanomocon	413
(Longchaeus) jamaicensis	390	Sportella lioconcha	419
(Triptychus) nivea	390	Stemodia schottii	476
Pyrite	186, 192	tomentosa	476
Pyroxenite	182, 187, 191	Stigmatophora argus	444
Pyrula carbacea	364	Strigilla pisiformis	426
pilsbryi	364	Strombiformis ischnon	395
Quartz	170, 172, 186-192	praelubrica	395
Retusa biforis	311	sarissiformis	394
sulcata fossilis	311	stimulus	395
Rhamphidia albitarsis	56	Strombina caribaea	350
mirabilis	55	caribaea miera	351
miranda	54	cyphonotus	351
sanguinolenta	55	haitensis	351
uniformis	56	politissima	351
Rhipidia (Arhipidia) annulicornis	54	prisma	351
domestica amazonensis	54	Strombinella acufornis	351
(Arhipidia) d. angustifrons	54	Strombus ambiguus	367
(Rhipidia) perarmata	52	ambiguus bifrons	367
(Conorhipidia) punctipennis	54		

dominator	366	Toxorhina brasiliensis	90
galliformis	366	centralis	91
haitensis	366	flavida	91
proximus	367	meridionalis	91
p. pugiloides	367	Trentepohlia (Paramongoma) ex-	
Styliola sulcifera	309	tensa	87
Supella supellectilium	226	(Paramongoma) femorata	88
Surcula humerosa	317	(Paramongoma) flavilla	89
jacquensis	317	(Paramongoma) fuscipes	88
longicaudata	317	(Paramongoma) geniculata	88
Syngnathus acus	444	(Paramongoma) longifusa	87
californiensis	443	(Paramongoma) pallipes	88
elucens	443	Trentonia flagellata	160
fuscus	443	Tribonidium amplum	243
louisianae	444	signaticollis	242
mackayi	443	Tribonium conspersum	242
materni	442	guttulosum	285
pelagicus	443	spectrum	285
pellegrini	444	Trifora nigrocincta	369
schlegelii	443	Trophon dominicensis	354
spicifer	442	Turbo dominicensis	395
Tanypremna longipes	93	Turbonilla (Nisiturris) angustula	392
Tegula viridula	396	(Nisiturris) aratibacillum	392
Teinostoma depressum	398	(Pyrgiscus) beatula	391
vitreum	399	(Nisiturris) contexta	392
Tellina alternata	424	(Pyrgiscus) dominicensis	391
(Merisca) errati	425	(Tragula) egressa	392
(Cyclotellina) fausta	425	(Chemnitzia) galeata	391
minuta	424	(Nisiturris) insititia	392
(Eurytellina) n. sp.	424	(Chemnitzia) peraequa	391
(Moerella) simpsoni	425	(Nisiturris) pertenuis	392
sp.	424	(Pyrgiscus) santodomingensis	391
Telphusa praefixa	6	(Careliopsis) turritelloides	391
Terebra baculiformis	316	(Nisiturris) undecimcostata	392
dislocata	316	Turris alba	316
gatunensis	316	rara	317
hitia	316	Turritella calostemma	377
Teredo (Kuphus) incrassata	428	domingensis	378
sp.	428	megalobasis	377
Teucholabis anthracina	85	perattenuata praecegens	377
decora	84	sulcigyrata	378
jocosa	86	tornata	377
lugubris	85	Typhis alatus	354
malanocephala	85	obesus	354
mendax	85	Typhlinus typhle	444
omissinervis	86	Vaganella undulata	309
parishi	87	Vasum dominicensis	344
persimilis	87	edificatum	344
pulchella	84	haitense	344
Thais santodomingensis	354	pugnus	344
Tinagma gigantea	17	tuberculatum	344
pulvilinea	17	Venericardia aversa	415
Tipula armatipennis nappoensis	98	santodomingensis	415
bezziana	99	Verbascum thapsus	481
diacanthos	97	Vermetus (Petalocochnus) do-	
effeta	100	mingensis	377
parishi	97	(Petalocochnus) laddfranklin-	
plumbethorax	101	ae	376
Torinia rotundata	379	Vermiculite	179, 186, 191, 192
Tourmaline	177, 183-188, 191, 192	Veronica arvenis	505

peregrina	504	parallela	313
p. xalapensis	504	Wellsite	188, 192
persica	505	Williamsite	453
polita	505	Xancus praeovoideus	343
scutellata	505	rex	342
Veronicastrum virginicum, ...	503	validus	342
Vexillum tortuosellum	341	Xenophora dilecta	385
t. frater	341	imperforata	385
tortuosum	341	Yoldia ovalis	402
Vitrinella (Solariorbis) amos-		Zetobora emarginata	209
browni	398	Zetoborella	210
(Episcynia) naso	397	gemmicula	211
Volvula cylichnoides	311	Zircon	184
ornata	311	Zoisite	185, 191
oxytata	312		

GENERAL INDEX

1921

-
- | | |
|--|---|
| <p>Alexander, Charles P. New or Little-known Craneflies from the Amazonian Region 39</p> <p>Braun, Annette F. Two Weeks' Collecting in Glacier National Park, 1 Committees, 537.</p> <p>Deaths announced, 537, 538.</p> <p>Fisher, Arthur H. An Animated Photographic Journey through the Philadelphia Zoological Gardens, 537 (No abstract).</p> <p>Fowler, Henry W. Notes on Hemibranchiate and Lophobranchiate Fishes, 437.</p> <p>Gordon, Samuel G. Desilicated Granitic Pegmatites, 169. The Chromite Deposits of the State Line Serpentine, 449.</p> <p>Hebard, Morgan. South American Blattidae from the Muséum d'Histoire Naturelle, Paris, France, 193</p> <p>Hughes, William E. Across the Peruvian Andes to the Amazon, 537 (No abstract).</p> <p>Members elected, 537-541.</p> | <p>Minutes of the Proceedings, Abstracts of the, 537-541.</p> <p>Officers, Councillors, and Committee on Accounts, 539, 540.</p> <p>Penard, E. Studies on some Flagellata, 105.</p> <p>Pennell, Francis W. Scrophulariaceae of the West Gulf States, 459.</p> <p>Pilsbry, Henry A. Revision of W. M. Gabb's Tertiary Mollusca of Santo Domingo, 305.</p> <p>Rehn, James A. G. The Academy Colombian Expedition of 1920 (No abstract)</p> <p>Skinner, Henry. A Collecting Trip to the Sierra La Sal, Utah, 538 (No abstract).</p> <p>Street, J. Fletcher. A Study of the Wild Bird Life of the New Jersey Coast, 538 (No abstract).</p> <p>Wanner, H. E. Some Faunal Remains from the Trias of York County Pennsylvania, 25.</p> <p>Wetmore, Alexander. A Fossil Owl from the Bridger Eocene, 455.</p> |
|--|---|

MBL/WHOI LIBRARY



WH 185M M

